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Sport Fishery Abstracts

Vol. 6 No. 4
Abstracts 4438 - 4642
October 1961

DEPARTMENT OF THE INTERIOR

Stewart L. Udall, Secretary

U. S. FISH AND WILDLIFE SERVICE

Clarence F. Pautzke, Commissioner

BUREAU OF SPORT FISHERIES AND WILDLIFE

Daniel H. Janzen, Director

The printing of this publication

was approved by the Director of

the Bureau of the Budget

January 4, 1961

Washington 25, D. C.

Sport Fishery Abstracts

An abstracting service for fishery research and management

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One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
Donald F. LaPointe, Editor
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4438. Davis, H. S., G. L. Hoffman, and E. W. Surber. 1961. NOTES ON SANGUINICOLA DAVISI (TREMATODA: SANGUINICOLIDAE) IN THE GILLS OF TROUT. The Journal of Parasitology, Vol. 47, No. 3, pp. 512-514.

The blood fluke, Sanguinicola davisi, was found in the blood vessels of the gill arches of Salmo clarki and Salmo gairdneri in Oregon. The development of the miracidium and its associated "cyst" is described. Heavy mortalities resulted from the damage done to the gills by the presence of the developing miracidia. (Auth. summ.)

4439. Lundbeck, Johannes. 1961. UNTERSUCHUNGEN UBER DIE KORPERPROPORTIONEN BEIM KABELJAU. Archiv fur Fischereiwissenschaft, Vol. XII, No. 1/2, pp. 1-24.

The variation in the length-weight relationship of the cod is paralleled especially by the body depth and, conversely, by the length-depth-indices. Besides the size of the eyes, and also of the fins, decreases with age, the anus is displaced distally. Other than by number of vertebrae (Schmidt) the body proportions reveal a North Sea - Norwegian and an Iceland - Greenland group of cod stocks, the latter being distinguished by a more short and high head with large eyes, less pronounced foremost part of the trunk and thus relatively proximal situation of the anus. The Greenland cod shows remarkable similarity to Gadus ogac, the characteristics of which also occur in the White Sea and, weakened, in the Baltic cod. (Auth. summ.)

4440. Darnell, Rezneat M. 1961. TROPHIC SPECTRUM OF AN ESTUARINE COMMUNITY, BASED ON STUDIES OF LAKE PONTCHARTRAIN, LOUISIANA. Ecology, Vol. 42, No. 3, pp. 553-568.

The Lake Pontchartrain community is a broadly open system exchanging nutrients, producers, and consumers with adjacent fresh-water and salt-water areas as well as with neighboring marshes and swamps.

Consumers within the lake apparently depend in great measure upon primary production which takes place outside the lake. Hence, the estuarine community may be trophically unbalanced.

The most conspicuous single food item in the diets of the consumers of this community is organic detritus with its attendant bacteria.

Individual species do not appear to conform to specific trophic levels on the basis of the following considerations:

(a) Omnivory on the part of most, if not all, of the major consumer species.

(b) Nutritional opportunism among the consumers.

(c) Ontogenetic change in the food habits of the consumers.

(d) Importance of organic detritus in the nutrition of the consumer species.

(e) Complex nature of the origin of detritus.

An alternative model of the trophic relations of the community is presented which represents the observed food on each species in the form of a spectrum and in which each type of food can be represented quantitatively and comparatively.

The really abundant consumer species of the Lake Pontchartrain community comprise two groups: those which feed heavily upon organic detritus and those which exhibit a broad range of food tolerance. (Auth. summ.)

4441. Digby, Peter S. B. 1961. THE VERTICAL DISTRIBUTION AND MOVEMENTS OF MARINE PLANKTON UNDER MIDNIGHT-SUN CONDITIONS IN SPITSBERGEN. The Journal of Animal Ecology, Vol. 3, No. 1, pp. 9-25.

The vertical distribution of the marine plankton has been studied in relation to light intensity under midnight-sun conditions in Isfjord and in the Sorgat, Spitsbergen.

Sagitta, Limacina, Beroe and Mertensia showed an increase in the proportion at the surface in the Sorgat during July and August. This increase was related to date rather than to light intensity at the time of sampling.

Calanus and Sagitta showed a limited amount of vertical movement in response to the changes of light intensity when the latter were adequate. Under continuously overcast conditions in mid-July vertical movement was not apparent in the tidal current of the Sorgat. When an overcast night followed a sunny day in mid-August the vertical movement was slight in the Sorgat but of the order of 30 m in less disturbed waters of Isfjord.

Sagitta, the amphipod Themisto and crustacean larvae were scarce in the 1 m and 10 m hauls in the Sorgat. Although Sagitta and the larger Themisto may have escaped the net, it is probable that the absence of the smaller forms from the surface layers was real and was due to pressure sensitivity. (Auth. summ.)

4442. Waters, Thomas F. 1961. STANDING CROP AND DRIFT OF STREAM BOTTOM ORGANISMS. Ecology, Vol. 42, No. 3, pp. 532-537.

The distribution of rates of drift of invertebrate animals among 5 Minnesota trout streams compared favorably with a ranking of expected productivities made on the basis of surrounding geology, water alkalinity, and available trout population data.

The distribution of standing crops of the bottom fauna among the 5 streams was not at all similar to the ranking of expected productivities nor to the distribution of drift rates, until the standing crop samples were qualitatively limited to groups or organisms having similar longevities. When the standing crop samples were limited only to those organisms having 2 or more generations per year, the distribution was similar to the ranking of expected productivities and remarkably close to the distribution of drift rates.

It is postulated that the mean rate of drift of invertebrate animals and qualitatively-limited standing crop may be useful as indices to the production of a stream bottom fauna. Of the 2, measurement of drift rate has the practical advantages of

smaller sampling error and the need for fewer samples, less effort in sorting and analysis of the samples, and a lack of the undesirable aspect of destroying the producing population. (Auth. summ.)

4443. Webb, Marjorie G. 1961. THE EFFECTS OF THERMAL STRATIFICATION ON THE DISTRIBUTION OF BENTHIC PROTOZOA IN ESTHWAITE WATER. The Journal of Animal Ecology, Vol. 3, No. 1, pp. 137-151.

A list of the Protozoa occurring at different depths on the bottom mud of Esthwaite Water is given, with an indication of those species which occur under anoxic conditions.

Of the Ciliata, three major groups emerge; those which are scattered randomly throughout conditions of high oxygenation and little putrefaction; those which are concentrated in regions of low oxygenation and much putrefaction; and those which are present in anoxic conditions. The latter group includes many 'sapropelic' forms.

The formation of transient communities of iron organisms is described; these associations appear at the boundary between oxidized and reduced conditions during calm weather. The filamentous matrices of iron bacteria and iron flagellates provide a foundation for the aggregation of a microflora and of a fauna, particularly ciliates, feeding on the microflora. A zone of considerable microbiological activity may thus to produced in the metalimnion, given suitable stable physical conditions of the water mass.

The necessity for more adequate micro-techniques of oxygen analysis is stressed, particularly with regard to the existing confusion in the literature concerning the distribution of Protozoa in relation to anoxia. (Auth. summ.)

4444. Deacon, James Everett. 1961. FISH POPULATIONS, FOLLOWING A DROUGHT, IN THE NEOSHO AND MARAIS DES CYGNES RIVERS OF KANSAS. University of Kansas Publications, Museum of Natural History, Vol. 13, No. 9, pp. 359-427.

The fauna of the Neosho and Marais des Cygnes rivers is capable of a wide range of adjustment in response to marked environmental changes. As these rivers become low and clear they take on many of the faunal characteristics of smaller tributaries and ponds. Species such as black bullhead, spotted bass, largemouth, white crappie, red shiner, rosy-faced shiner, blunt-faced minnow, mimic shiner, and slender madtom assume a more prominent position in the total population. Other species such as channel catfish, flathead, freshwater drum, blue sucker, and such riffle-dwelling species as the gravel chub, Neosho madtom, and slender-headed darter hold a less prominent position in the total population.

When permanent flow is re-established the more mobile and the more generalized species (with respect to habitat) are able to utilize the available space immediately. As a result, these species increase rapidly in numbers. The increase occurs both by movement from more permanent waters and by reproduction. Channel catfish, flathead, freshwater drum, and river carpsucker are mobile species (Funk, 1957; Trautman, 1957) and long-nosed gar probably are mobile. Individuals that move supplement those that survive in residual pools, and provide brood stock adequate to produce a large year-class in the first year of permanent flow. (From auth. concl.)

4445. Jackson, P. B. N. 1961. THE IMPACT OF PREDATION, ESPECIALLY BY THE TIGER-FISH (HYDROCYON VITTATUS CAST). ON AFRICAN FRESHWATER FISHES. Proceedings of the Zoological Society of London, Vol. 136, Part 4, pp. 603-622.

Study of Hydrocyon vittatus reveals that this fish, while a fierce and voracious predator, nearly always swallows the prey fish whole. Because of this the impact of predation is upon fish less than 40 per cent of the predator's length. The size structure of Hydrocyon populations is such that the main predation pressure is upon fishes of small size, the danger of predation becoming progressively less until a critical length, usually about 18-20 cm., is reached, above which a prey fish is reasonably safe from predation. The impact of predation is upon those fish which are mostly abundantly available to the predator, though these may not necessarily be the most abundant fish in the area. The use of cover, in the form of submerged vegetation or of very shallow areas of water, by fish which are small when adult or by the juveniles of larger species, is extensive. It is postulated that both the absolute number of fish and number of fish species which are small when adult, in an area inhabited by Hydrocyon vittatus, and possibly also Lates niloticus subspp., is governed by the amount of vegetal cover available throughout the year and that the spawning migrations of fishes, being found only among those species or very closely related species, which are or have once been in contact with these voracious predators, is primarily undertaken in order to place the young in an environment where refuge from these predators is available. The view that the presence of these predators has the effect of retarding speciation is supported. (Auth. abst.)

4446. Robson, D. S. 1961. ON THE STATISTICAL THEORY OF A ROVING CREEL CENSUS OF FISHERMEN. Biometrics, Vol. 17, No. 3, pp. 415-437.

In order to estimate the day's total catch from a fishery an enumerator roves through the fishing area interviewing fishermen as he encounters them to determine the number n of fish caught and the time t expended. The interviewer is assumed to (i) start his trip at a randomly chosen point along a well defined route which completely covers the fishery, (ii) choose his initial direction at random from the two alternatives, and (iii) travel at a constant rate of c circuits per day. If the catch rate n/t at time of interview is an unbiased estimator of a fisherman's catch rate for his completed trip and if the fishermen's movements relative to the interviewer's path never exceed the interviewer's rate c, then rn/ct, summed over all interviews, is an unbiased estimator of the

day's total catch. The unit of time is one day, r is the number of times the fisherman was interviewed, and n/t is the catch rate at the r'th interview.

Unbiasedness of n/t implies that the waiting times to first catch and from first to second catch are identically distributed chance variables, and that all waiting times between successive catches have the same expected value. If waiting are independent, then unbiasedness implies that fishing is a Poisson process. (Auth summ.)

4447. Yashouv, A., and J. Chervinski. 1961. THE FOOD OF TILAPIA NILOTICA IN PONDS OF THE FISH CULTURE RESEARCH STATION AT DOR. Bamidgeh, Vol. 13, No. 2, pp. 33-39.

Most investigations dealing with T. nilotica and its feeding habits consider the adult to be plankton feeder - especially of phytoplankton. In our observations in fish ponds we came to the same conclusion as did Lowe (1958), that the dietary habits of T. nilotica is capable both of straining food from the water and of gathering from the substrate. Both manners of feeding are implented when necessity dictates. It was noted that in fish ponds stocked by T. nilotica, the filamentous algae disappeared rapidly. Among the types of diatoms consumed by T. nilotica are found many species which develop and grow on the substrate. The remains of higher plants, waterbugs, chironomid larvae and particles of soil found together with algal plankton in the fishes' intestine indicate the wide spectrum of the T. nilotica's nutritional capabilities. With all this, the decided preference for plankton food is unmistakable. (From auth. disc.)

4448. Miller, David. 1961. A MODIFICATION OF THE SMALL HARDY PLANKTON SAMPLER FOR SIMULTANEOUS HIGH-SPEED PLANKTON HAULS. Bulletins of Marine Ecology, Vol. V, No. 45, pp. 165-172.

A high-speed plankton sampler specifically designed for the study of the vertical distribution of larval fish is described, and the method of its operation noted.

Tests indicate that the filtering capacity of the sampler is relatively constant with several mesh sizes and over a range of towing speeds from 5-10 knots.

Estimates of the sampling error introduced by the difference in volume strained between the surface and deeper samplers are given. The estimated values of these errors appear to be well within acceptable tolerances for biological data.

The samplers have been used effectively in a study of the vertical distribution of haddock larvae. Results of this study indicate that the daytime escapement of active zooplankton forms generally encountered in the use of slow-moving nets is virtually eliminated. (Auth. summ.)

4449. Glover, R. S. 1961. THE MULTI-DEPTH PLANKTON INDICATOR. Bulletins of Marine Ecology, Vol. V, No. 44, pp. 151-164.

An improved model of the plankton sampler designed by Glover (1953) is described. It can be used to provide horizontal hauls simultaneously at a number of different depths. It has been developed from the basic design of the Hardy Plankton Indicator.

There is a description of alternative towing eyes which are placed at the side of the Indicator and behind the sampling aperture.

The plankton can be collected on a flat disc of silk or in detachable nets of various sizes.

Multi-depth plankton Indicators have been towed on 1/4 inch diameter wire using a Scripps cable depressor. The convenient lower limit of sampling is 40 metres at speeds of 8-9 knots.

Laboratory measurements suggest that the discs and nets present very slight resistance to the flow of water through the Indicator. (Auth. summ.)

4450. Bullock, G. L. 1961. A SCHEMATIC OUTLINE FOR THE PRESUMPTIVE IDENTIFICATION OF BACTERIAL DISEASES OF FISH. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 147-151.

A schematic outline, or flow chart, is presented to assist in the presumptive diagnosis of bacterial diseases of fish. Specific methods for the identification of each organism are described. (Auth. abst.)

4451. Saksena, Vishnu P., Kiichiro Yamamota, and Carl D. Riggs. 1961. EARLY DEVELOPMENT OF THE CHANNEL CATFISH. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 156-161.

Eggs for the study of the early development of the channel catfish, Ictalurus punctatus, were obtained by means of hormone-induced spawning in aquaria. Development was characterized by a relatively small blastodisk; lack of a recognizable, true blastocoele; early occurrence of a projected caudal knob; and a marked neural furrow. The embryo differentiated the optic vesicles, auditory placodes, and more than 10 somites by the time of the closure of the blastopore, about 30 hrs. after spawning. The pectoral fin-bud state, about 3.5 mm. long and with about 24 somites, was reached in 34 hrs. (Auth. summ.)

4452. Ryder, R. A. 1961. LYMPHOCYSTIS AS A MORTALITY FACTOR IN A WALLEYE POPULATION. Progressive Fish-Culturist, Vol.23, No. 4, pp. 183-186.

The rate of tag returns was slightly greater from lymphocystis-infected walleyes, Stizostedion v. vitreum, than from sound fish. This may have been because the infected fish, which were covered with "warty" protuberances, were more vulnerable to capture by gill nets. Lymphocystis was not considered a serious mortality factor in walleyes; most fish having lumphocystis in the spring months bore no traces of the disease during the remainder of the year. Infestation rates in the walleye population studied exceeded 24% during the spring spawning runs in 1956 and 1957. During the spawning run in 1956, infestation rates increased from 17.5% at the start to 30.4% 10 days later. (Auth. abst.)

4453. Corson, Bernard W., and Peter E. Brezosky. 1961. HATCHERY PRODUCTION EXPERIMENT DESIGNED TO PREVENT SUNBURN IN LANDLOCKED SALMON. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 175-178.

An investigation was conducted at the Powder Mill Rearing Station to minimize the harmful rays of sunlight on subdermal layers of yearling landlocked salmon (Salmo salar). A spray system was used to break the upper layer of water and thereby deflect the sun rays; pools were covered with saran cloth to provide a 90% calculated shade to prevent direct sunlight; and diets were supplemented with amounts of niacin that appeared reasonable without causing physiological damage. Covering the pools with saran cloth gave positive results, and this group of experimentals did not develop symptoms of sunburn. (Auth. abst.)

4454. Sharpe, F. Phillip. 1961. A MID-SUMMER PLANT OF RAINBOW TROUT IN A STRATIFIED TENNESSEE IMPOUNDMENT. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 152-155.

Skin-diving equipment was used during the summer to stock rainbow trout (Salmo gairdneri) in a stratified Tennessee impoundment. Plastic bags were used to transport the fish into the thermocline. The reactions of the fish were observed during transfer from the tank truck to the lower layer of water and for several minutes after the fish were released at depths of 12 to 15 ft. Fish released in the thermocline were initially confused, but apparently suffered no ill effects, and adapted to the new environment far better than fish released in the hot surface water. (Auth. abst.)

4455. Pyle, Earl A., Glen Hammer, and Arthur M. Phillips, Jr. 1961. THE EFFECT OF GRADING ON THE TOTAL WEIGHT GAINED BY BROOK TROUT. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 162-168.

Grading fish populations into size groups did not increase the total weight gained by the brook trout (Salvelinus fontinalis). Any differences noted between the growth rates of the size groups were the same whether the fish were removed from or allowed to remain with their original population mates. The value of grading trout cannot be questioned in providing fish of a definite size for use in managed waters or for improving certain phases of hatchery management, but it is questionable if the fish are graded solely for increased hatchery production or efficiency of food conversion. (Auth. abst.)

4456. Sneed, Kermit E., and Harry K. Dupree. 1961. EFFECT OF THYROID-STIMULATING HORMONE COMBINED WITH GONADOTROPHIC HORMONES ON THE OVULATION OF GOLDFISH AND GREEN SUNFISH. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 179-182.

Gravid goldfish, Carassius auratus, and gravid green sunfish, Lepomis cyanellus, were used to demonstrate the effect of thyroid-stimulating hormone (TSH) combined with human chorionic gonadotrophin or fish pituitary on the ovulation of fishes. Thyroid-stimulating hormone alone did not precipitate ovulation in the goldfish at levels as high as 10 units per lb., but 25 units per lb. in the green sunfish produced an abnormal ovulation. In the goldfish, ovulations were not obtained when 1.3 units of TSH was combined with 225 I. U. of chorionic gonadotrophin or 0.5 mg of fish pituitary, but ovulations were obtained when either 2.5 or 5.0 units of TSH was combined with 225 I. U. of chorionic gonadotrophin or 0.5 mg of fish pituitary. Used alone, 450 I. U. of chorionic gonadotrophin or 2 mg of fish pituitary was required to ovulate goldfish. In the green sunfish, three injections of 225 I. U. of chorionic gonadotrophin combined with 2.5 or 5.0 units of TSH resulted in the ovulation of all the fish, but use of 4 times that amount of chorionic gonadotrophin alone produced no ovulation. Also, in the green sunfish, 3 injections of 0.5 mg of fish pituitary combined with 5.0 units of TSH resulted in ovulation of 2 or 3 fish, but no ovulation occurred when 4 times that amount of fish pituitary was used alone. (Auth. abst.)

4457. Bouthillier, L. P. 1961. THE INFLUENCE OF VARIOUS DIETS ON TROUT GROWTH AND PIGMENTATION. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 169-174.

Using the growth method, the nutritive value of 18 different diets was studied on brook trout (Salvelinus fontinalis) fingerlings.) Beef liver was used as the standard comparison diet, and each other diet consisted of beef liver mixed in varying proportions with other food substances. Of special interest were the findings that (1) the fish fed the diets containing shrimp meal showed remarkable pigmentation of the fins, (2) the fish fed the diet consisting of beef liver and fresh fish in equal amounts developed beautiful pigmentation on the body, (3) trout growth was enhanced by the addition of iodine to each diet. (Auth. abst.)

4458. Cope, Oliver B. 1961. STANDARDS FOR REPORTING FISH TOXICITY TESTS. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 187-189.

Improvement in reporting procedures for field and laboratory testing of fish versus pesticides is necessary. On the basis of details provided in many reports, it is often difficult to compare responses. Reports should include full information on the characteristics of the fish, the features of the environment in which the work was done, and the details of the methods used for testing and analysis. (Auth. abst.)

4459. Craddock, Donovan R. 1961. AN IMPROVED TRAP FOR THE CAPTURE AND SAFE RETENTION OF SALMON SMOLTS. Progressive Fish-Culturist, Vol. 23, No. 4, pp. 190-192.

This is a description of a trap, economical to construct and operate, that has the fish-catching ability of a fyke net plus the advantage of retaining

the captured fish alive. Three of these traps caught 37,000 blueback salmon (Oncorhynchus nerka) smolts during a 6-week migration and held as many as 3,000 in good condition for periods up to 10 hrs. Some size selectivity was noted. (Auth. abst.)

4460. Dawson, C. E. 1961. NOTES ON A SECOND RECORD OF BRANCHIOSTOMA FROM LOUISIANA. Copeia, No. 2, p. 242.

This specimen, now in the collections of the Gulf Coast Research Laboratory, constitutes the first Louisiana record of Branchiostoma taken west of the Mississippi River and is apparently the only record between Chandeleur Island, Louisiana and Freeport, Texas (Hoese, 1958. Publ. Inst. Mar. Sci. 5:315). The apparent rarity of the lancelet in the Grand Isle area is supported by its absence from a faunal list (1950. Behre, Occ. Pap. Mar. Lab. La. State Univ. 6:1-66) covering some 18 years of more or less continuous collections in this region. Mud bottoms predominate and the absence of extensive sandy areas, the preferred habitat of the genus, probably limits the distribution of Branchiostoma in this portion of the Louisiana coast. (Auth.)

4461. Gilbert, Carter R. 1961. HYBRIDIZATION VERSUS INTERGRADATION: AN INQUIRY INTO THE RELATIONSHIP OF TWO CYPRINID FISHES. Copeia, No. 2, pp. 181-192.

It has recently become evident that a rigid definition of a species or subspecies is unrealistic, and that the distinction between these taxonomic categories is often a matter of degree and subject to much subjective interpretation. Systematic researches on various groups of North American fresh-water fishes have contributed importantly to this reappraisal.

Criteria for the determination of hybrids and intergrades are presented, and pertinent discussions are given of hybridization between members of the families Centrachidae and Cyprinidae. The relationships between populations of the amphibian, Rana pipieus, are also discussed.

Hybrid offspring resulting from crosses between species of the centrarchid genus Lepomis agree well in their morphological and physiological characteristics with the criteria cited above. The relationships between certain cyprinids, such as Notropis cornutus and N. rubellus, N. chrysocephalus and N. rubellus, N. lutrensis and N. venustus, Chrosomus eos and C. neogaeus, and Carassius auratus and Cyprinus carpio, are not as evident, and are indicative of the complex interactions that may occur. The situation involving Notropis cornutus and Notropis chrysocephalus, two forms which heretofore have been regarded as subspecies, is extremely complicated. Evidence is presented to indicate a specific relationship between these forms. (From auth. summ.)

4462. Slater, John V. 1961. COMPARATIVE ACCUMULATION OF RADIOACTIVE ZINC IN YOUNG RAINBOW, CUTTHROAT AND BROOK TROUT. Copeia, No. 2, pp. 158-161.

An analysis of the comparative accumulation of radioactive zinc in young rainbow, cutthroat and brook trout reveals that the greatest rate of accumulation of this isotope is found in the brook trout with the least amount being accumulated by the rainbows. A study on the localization of this element showed that in the rainbow trout and the cutthroat, the gill filaments accumulated the greater amount of isotope while in both instances the least amount was discovered in the ventral body wall. Ion uptake in the cutthroat gill was greater than in that of the rainbow with this latter species being found to accumulate only about one-half that discovered in the cutthroat gill.

The rate of accumulation of zinc in the rainbow trout was only 75 percent that found in the brooks. The final total concentration of the ion in 48 hours was found to be greatest in the brook trout, with about 95 percent of this concentration being found in the cutthroats and about 70 percent of the highest concentration seen in the rainbows. (Auth. summ.)

4463. Hubbs, Clark. 1961. DEVELOPMENTAL TEMPERATURE TOLERANCES OF FOUR ETHEOSTOMATINE FISHES OCCURRING IN TEXAS. Copeia, No. 2, pp. 195-198.

Two species that spawn during winter and spring have eggs and larvae that can survive temperatures colder than two related species that spawn later. (Auth. concl.)

4464. Hubbs, Clark. 1961. DIFFERENCES IN THE INCUBATION PERIOD OF TWO POPULATIONS OF ETHEOSTOMA LEPIDUM. Copeia, No. 2, pp. 198-200.

Greenthroat darter eggs from the Nueces River system have a longer incubation period than do those from the Colorado and Guadalupe systems at temperatures between 12°C. and 21°C. At more extreme developmental temperatures 9° to 11°C. and 22° to 26°C. the difference is less pronounced and the Nueces eggs appear to hatch more rapidly than the others.

The hybrid reciprocals tend to approach the developmental rate of their respective maternal controls. (Auth. summ.)

4465. Gunter, G. 1961. SALINITY AND SIZE IN MARINE FISHES. Copeia, No. 2, pp. 234-235.

Several criteria should be used in definitive studies of salinity and size relations of marine animals.

1. Sampling should follow at least one annual cycle so as to cover the full size range of the species, and adequate samples of all sizes should be collected.

2. The full salinity range over which the species lives should be sampled.

3. Each specimen should be related specifically to the salinity at which it was caught. All data collected must be used and selection prejudices the case. (Auth.)

4466. Gulland, J. A. 1961. FISHING AND THE STOCKS OF FISH AT ICELAND. Fishery Investigations, Series II, Vol. XXIII, No. 4, 51 pgs.

The statistics of catches of demersal fish at Iceland in the past 50 years are reviewed. Cod is the most important species, yielding up to nearly half a million tons. The best available measure of the abundance is the catch per ton-hour. This measure shows that the average abundance of cod has not changed very greatly over the past 50 years. Fluctuations have been caused by varying strengths of year-classes, those of 1922 and 1945 being outstandingly good.

The total amount of fishing on the stocks has been calculated in equivalent English ton-hours. The present level of fishing has been sufficient to reduce the abundance of the stocks of cod, but this reduction is not great, and increased effort would result in increased catch. The greatest catch with the present pattern of fishing would probably occur with twice the present amount of fishing. Conversely, reduction or restriction of fishing would result in a reduction in the catch of cod.

Increased catches could also be obtained by avoidance of capture of the smallest sizes of fish, thus allowing them to grow to a bigger size. The most direct method is by increased trawl mesh size, and an increase from 110 mm to 130 mm would increase the catches by an average of 4%. Much of this increase would be due to the saving of small fish at present caught, but rejected at sea as being too small to market. Closure to fishing of 'nursery' areas inhabited predominantly by small fish would have a similar effect, but the present data do not allow such areas to be determined. A combination of increased fishing and protection of the small fish could give greatly increased catches, 50% or more above the present average.

Plaice and haddock both show much more severe effects of fishing, their abundances at present being only around 15% and 25% respectively of those when there was no fishing. For both species an increase in amount of fishing would result in a decrease in catch. The plaice appears to have benefited from the closure in 1952 of the nursery grounds inside the 4-mile limit, catches and abundance being greater for a given amount of fishing. Haddock would benefit greatly from protection of the small fish. The greatest yield (perhaps 40% above the present) with the present amount of fishing would be obtained with a 180 mm trawl mesh. As a step in these directions meshes of 130 mm are suggested, giving steady yields perhaps 25% above the present. Larger meshes would release fish at present marketable, and their use would cause an immediate drop in catches of 7%, 19% or 50% for the 130 mm, 150 mm or 180 mm meshes respectively. These losses would only fall on the trawlers catches, while the benefit would be received by all those catching haddock, whatever the gear. Trawlers catch the bulk of the haddock (70% in 1957), and would still have a net benefit, though not as large as the increase of total catch would suggest

The other demersal species caught at Iceland are not analysed in detail, but most of them show some effect of fishing - coalfish and ling distinctly, redfish and lemon sole not so much. An increase of trawl mesh size to 130 mm would give greater catches of coalfish, possibly also of ling. For no species would the long-term catches decrease with the 130 mm mesh.

4467. Hubbs, Clark, and Charles Michael Laritz. 1961. OCCURRENCE OF A NATURAL INTERGENERIC ETHEOSTOMATINE FISH HYBRID. Copeia, No. 2, pp. 231-232.

On October 10, 1960, we collected a hybrid darter from the San Marcos River at the original site of San Marcos, 3 miles east of the present city in Hays County, Texas, Mr. Richard Hewitt and Dr. and Mrs. H. G. Merriam assisted us in the field work. It was identified in the field as a hybrid between Etheostoma spectabile and Hadropterus scierus. Subsequent examination in the laboratory supports the field identification. (Auth.)

4468. Fritz, Raymond L. 1961. SIZE DISTRIBUTION BY DEPTH OF THE LONGFIN HAKE, PHYCIS CHESTERI. Copeia, No. 2, pp. 229-230.

Longfin hake tend to be distributed by size according to depth along the continental slope. The largest longfin hake measured 42 cm. and was taken between 400 and 500 fathoms. (Auth.)

4469. Strasburg, Donald W., and John C. Marr. 1961. BANDED COLOR PHASES OF TWO PELAGIC FISHES, CORYPHAENA HIPPURUS AND KATSUWONUS PELAMIS. Copeia, No. 2, pp. 226-228.

A cursory search of the literature and available photographs reveals that vertical bars are common among pelagic fishes. In addition to the ephemeral bands of adult Coryphaena and Katsuwonus, we note more or less permanent bars or bar-like rows of spots on adult Neothunnus, Acanthocybium, Istiophorus, Makaira, Naucrates, and Ranzania, and on juvenile Coryphaena and Neothunnus, among the more conspicuous pelagic forms. Because of the similarity in ecological positions of most of these fishes, it is tempting to postulate an adaptive importance for the bars. To the submerged human eye they render the fish neither more nor less conspicuous, for the marks are only visible at short range, long after the fish has come into view. (When viewed from above the surface of the water they do, however, have the effect of presenting an unfamiliar pattern on a familiar silhouette, thus making sight identifications difficult). Whether bars have a communicative function between fish is a question to be answered only after more detailed observations than we have been able to make. (Auth.)

4470. Counts, Robert C. 1961. A DEVICE FOR MEASURING LARVAL AND JUVENILE FISHES. Copeia, No. 2, pp. 224-226.

During studies of early development of several fishes, a method of measuring larvae and juveniles which made use of a graduated mechanical stage was devised. By the use of this method accurate

body measurements can be made to one tenth of a millimeter on fish ranging in size from the smallest larva to a maximum standard length of 107 mm. No change in calibration is required with change in magnification as is necessary when using an ocular micrometer. Furthermore, the inherent inaccuracy of other methods, caused by relocating reference points after each measurement, is eliminated. (Auth.)

4471. Rosen, Donn Eric, and Arlene Tucker. 1961. EVOLUTION OF SECONDARY SEXUAL CHARACTERS AND SEXUAL BEHAVIOR PATTERNS IN A FAMILY OF VIVIPAROUS FISHES (CYPRINODONTIFORMES: POECILIIDAE). Copeia, No. 2, pp. 201-212.

Elaborateness of precopulatory mating behavior in the members of 13 genera of poeciliid fishes is found related to the length of the external male genitalium (modified anal fin or gonopodium) and the presence or absence of specializations of the paired fins that assist gonopodial action. It is suggested that the underlying difference between the sexual behaviors of species with long and short gonopodia involves the differential utilization of visual, tactile and kinesthetic stimuli necessary for the successful transfer of sperms.

It is noted that the viviparous Poeciliidae differ from all groups of oviparous cyprinodonts in the more anterior insertion of the anal fin. Its forward shift in the body brings the gonopodium into closer alignment with the fish's center of gravity and its central visual field, thus enabling the fish to exercise more complete control over its use during the complex mating maneuvers. During the evolution of the anterior type of anal fin insertion, the effectiveness of the gonopodium may have been further enhanced by (1) a pronounced elongation of the genitalium itself, and/or (2) the development of bilateral accessory structures and tactile organs that greatly aid positioning and stabilizing a shorter gonopodium during erection.

Males of species with long gonopodia may be primarily visually oriented and may therefore be able to contact the female while she is in motion. Males of species with shorter gonodopia may rely more heavily on kinesthetic and tactile cues; copulatory contacts are typically made while the female is stationary. In the latter forms, elaborate display and occasional male secondary sexual coloration may evoke in the female a response to slow down or stop.

Whereas elaborate preparatory display, color dimorphism and modifications of the paired fins have evolved so that they enhance the effectiveness of the short type of gonopodium, permanent structural asymmetry may have arisen for the same reason in the long gonopodium. A profound influence of asymmetry of the gonopodial system on certain behavioral items is demonstrated. (Auth. summ.)

4472. Fraser, J. H. 1961. THE SURVIVAL OF LARVAL FISH IN THE NORTHERN NORTH SEA ACCORDING TO THE QUALITY OF THE SEA WATER. Journal of the Marine Biological Association of the United Kingdom, Vol. 41, No. 2, pp. 305-312.

The numbers of fish eggs and planktonic stages of fish taken during a 5-year period by the Scottish research vessels in the northern North Sea have been associated with the presence of Sagitta elegans and S. setosa in the same collections and over an 11-year period with the presence or absence of S. elegans. The results confirm Russell's findings in the English Channel that fish larvae are more abundant when S. elegans is present than when S. setosa is present.

The total numbers of fish eggs do not show these differences; spawning does not appear to be any more productive in water associated with S. elegans, rather the reverse, and this is shown to be so for the eggs of those species separately examined. Numbers of the larvae were distinctly greater in the 'mixed' conditions indicated by the presence of S. elegans and a more abundant food supply is a possible cause. That the differences may signify a more fundamental effect, however, is suggested by the figures for cod and haddock eggs, which show the earliest stages to be more abundant where S. elegans was absent although later stages were more abundant when S. elegans was present. (Auth. summ.)

4473. Schaeffer, Bobb. 1961. DIFFERENTIAL OSSIFICATION IN THE FISHES. Transactions of The New York Academy of Sciences, Vol. 23, No. 6, pp. 501-505.

The adaptive significance of the distribution and density of cartilage and bone in the adult fish skeleton must be related to the interplay of at least four factors; mechanical stress, equilibrium, buoyancy, and protection, Calcified cartilage and bone represent two different ways of strengthening the skeleton. The ultimate superiority of bone over cartilage as a stress-resisting tissue is evidenced by the nearly universal occurrence of bone in the Osteichthyes, which have attained the greatest feeding and locomotor efficiency among the fishes. (Auth. summ.)

4474. Pearcy, W. G. 1961. SEASONAL CHANGES IN OSMOTIC PRESSURE OF FLOUNDER SERA. Science, Vol. 134, No. 3473, pp. 193-194.

The freezing point depression of sera collected from flounder during the winter averaged 1.15°C, whereas it averaged 0.63° C for sera collected during the summer. Elevated concentration of sodium and chloride ions were found for the winter samples of sera, but NaCl explained only a fraction of the seasonal increase in osmolarity. (Auth. abst.)

4475. Round, F. E. 1961. STUDIES ON BOTTOM-LIVING ALGAE IN SOME LAKES OF THE ENGLISH LAKE DISTRICT. PART VI. THE EFFECT OF DEPTH ON THE EPIPELIC ALGAL COMMUNITY. The Journal of Ecology, Vol. 49, No. 2, pp. 245-254.

The distribution of algae on sediments of Windermere and Blelham Tarn at depths from 1 m down to 12 m has been recorded over a period of 1 year. The seasonal growth cycle at each depth is

discussed in relation to the more detailed sampling at shallow stations on these and other lakes and to the environmental factors. Growth of algae is considerably reduced at 6 m and below 8 m is practically nil. There was not a steady decrease in growth from 1-6 m. Growth was probably at its optimum at 3 m and at 2 and 4 m the population was reduced, possibly related to a physical removal of cells. The gross algal productivities of both Bacillariophyceae and Cyanophyceae in the littoral zone followed the seasonal variation in light and temperature. (Auth. summ.)

4476. Sloane, J. F., R. Bassindale, Elizabeth Davenport, F. J. Ebling, and J. A. Kitching. 1961. THE ECOLOGY OF LOUGH INE. IX. THE FLORA AND FAUNA ASSOCIATED WITH UNDERGROWTH-FORMING ALGAE IN THE RAPIDS AREA. The Journal of Ecology, Vol. 49, No. 2, pp. 353-368.

The distribution and abundance of animals and plants living on the small sublittoral algae of the Lough Ine Rapids area have been examined. Diagrams for fifteen species of animals, a table and a list of 66 algae and 214 animals are given.

Of the thirty-nine species present in sufficient abundance to analyse, five showed a preference for living in areas of fast current and fifteen for areas of quiet water. Of the remaining species, some showed a definite preference for areas of medium current.

A number of otherwise widely distributed species were absent either from Station No. 5 or Codium Bay or both. This was attributed to the very fast currents at Station No. 5 and to the extreme stagnation at Codium Bay.

No species showed a clear preference for living on a particular species of substrate alga. (Auth. summ.)

4477. Lloyd, R. 1961. EFFECT OF DISSOLVED OXYGEN CONCENTRATIONS ON THE TOXICITY OF SEVERAL POISONS TO RAINBOW TROUT (SALMO GAIRDNERII RICHARDSON). The Journal of Experimental Biology, Vol. 38, No. 2, pp. 447-455.

A given reduction in the dissolved oxygen concentration of the water from the air-saturation value to a lower level increases the toxicity to rainbow trout of zinc, lead and copper salts, and of a mixture of monohydric phenols, to about the same extent.

The effect of a reduced oxygen concentration on the toxicity of ammonia solutions is greater than that found for the other four poisons; the extra increase can be accounted for by a theoretical calculation of the difference between the pH value of the bulk of the solution and that at the gill surface.

An hypothesis is presented to account for the effect of low oxygen concentrations on the toxicity of poisons to fish. It assumes that a given toxic effect is produced by a specified concentration of poison at the gill surface, and suggests that this concentration is governed not only by the concentration of poison in the bulk of the solution but also by the velocity of respiratory flow. (Auth. summ.)

4478. Osborne, M. F. M. 1961. THE HYDRODYNAMICAL PERFORMANCE OF MIGRATORY SALMON. The Journal of Experimental Biology, Vol. 38, No. 2, pp. 365-390.

The annual spawning migration of Pacific Coast salmon up the Columbia and Amur rivers has been analysed as an experiment on the maximum range of an unrefuelled vehicle, since the fish do not eat during this migration. The fuel (primarily fat) available to real fish is compared to that computed for an equivalent rigid vehicle with the following performance specifications which may be regarded as optimum ones for marine vehicles.

A choice for the speed of ascent against the average river current corresponding to the least fuel consumption, without seeking systematically either low- or high- velocity water.

A drag coefficient corresponding to a turbulent boundary layer with no separation.

An overall efficiency of 25% for converting the heat of combustion of the fuel to directed kinetic energy in the wake. Under these assumptions, the vehicles usually require slightly more fuel than the corresponding fish which they are intended to approximate; in the case of blueback salmon, the vehicle requires about five times as much. One, therefore, concludes that the fish have a performance superior to that of the best engineered rigid vehicles, as defined and operated under the above three specifications. Suggested explanations for the apparently superior performance of the fish are:

(1) a deliberate seeking, by the fish, of low-velocity water close to the bottom or shoreline;

(2) the ability of the fish to maintain a laminar rather than turbulent boundary layer;

(3) the ability of the fish to extract energy from the turbulent velocity fluctuations of the river.

Analysis of salmon counts over the Bonneville and Rock Island dams on the Columbia River shows that the average velocity of the fish upstream is influenced by the velocity of the water downstream in the following peculiar fashion, depending upon whether one considers water-velocity variations through the course of a year, or variations at a fixed season of the year, from one year to the next. The general effect of the water velocity as it varies through a year, is to slow the fish down when the water velocity is large (at the June flood peak) and to permit faster ascent when the water velocity is less, in both preceding and following months. But at a fixed season of the year, prior to the flood peak in June, relatively high-velocity water speeds the fish up. At a fixed season after the flood peak, relatively high-velocity water slows them down. These relationships are in agreement with other biological observations and with an analysis of navigation for minimum fuel consumption.

Data and methods are given permitting a calculation of the average water velocity in the Columbia River, from the mouth to the headwaters, for any season of the year. (Auth. summ.)

4479. De Sylva, Donald P., and Warren F. Rathjen. 1961. LIFE HISTORY NOTES ON THE LITTLE TUNA, EUTHYNNUS ALLETTERATUS, FROM THE SOUTHEASTERN UNITED STATES. Bulletin of Marine

Science of the Gulf and Caribbean, Vol. 11, No. 2, pp. 161-190.

The little tuna, Euthynnus alletteratus (Rafinesque), was the species most frequently brought in to the fishing dock at Pier 5, Miami, Florida, between September, 1952 and August 1953. During this period, 1340 were examined, the period of greatest abundance being during the summer months. Data were collected on lengths, weights, frequency of occurrence, stomach contents and the reproductive cycle. Additional specimens were examined during the summer of 1951 between Cape Hatteras, North Carolina, and Cape Canaveral, Florida. Data are presented on the monthly and overall size distribution of fish taken, and growth is discussed on the basis of length frequencies. Male specimens of little tuna were found in a ripe condition from February through November, and ripe females occurred from January through November. Although the adults are typically inshore forms, occurring in less than 20 fathoms, the young are more common over deep water. Sex ratio and size at maturity are also discussed, and the food and feeding habits are reviewed. (Auth. abst.)

4480. Price, Joseph B., and Richard R. Priddy. 1961. RAPID VOLUMETRIC DETERMINATIONS OF SULPHATE, CALCIUM, AND MAGNESIUM IN HIGH LIME-MAGNESIUM BRACKISH COASTAL WATERS. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 11, No. 2, pp. 198-206.

Rapid methods for determining the sulphate, calcium, and magnesium content of brackish coastal waters are desired by geologists and biologists working in Mississippi Sound. They need daily, even hourly, analyses to correlate with other records. Investigators on other coasts have the same need. Gravimetric and colorimetric methods are too slow and ponderous and are too difficult to use on shipboard. However, new titrants and new indicators permit titrating brackish water for sulphate, calcium, and magnesium ions in 5 to 10 minutes, each, Procedures are modifications of recognized methods. The disodium dihydrogen dihydrate of Ethylenediaminetetraacetic acid (EDIA) is used as a titrant to complex barium, calcium, and magnesium ions. Only three samples of brackish water are necessary: one to determine the amount of combined calcium and magnesium; and one to find the amount of calcium alone. Simple calculations show the amounts of sulphate, calcium, and magnesium ions. (Auth. abst.)

4481. Parry, Gwyneth. 1961. OSMOTIC AND IONIC CHANGES IN BLOOD AND MUSCLE OF MIGRATING SALMONIDS. The Journal of Experimental Biology, Vol. 38, No. 2, pp. 411-427.

Osmoregulation of the Atlantic salmon in fresh water and sea water, and during transfers from one salinity to another, has been studied by measuring the freezing point and the levels of some inorganic ions in the blood plasma, and water content and ions in whole muscle.

An increase in blood concentration of about 12% follows the transfer of juvenile fish (smolts) from fresh water to sea water; and a fall of concentration of about 5% follows the transfer of the adult fish from sea water to fresh water.

Some changes in analyses of whole muscle indicate changes in the extracellular compartment during transfers from one salinity to another.

Osmoregulatory powers of juvenile salmon (smolts) and fresh-run adults are good, but spent fish (kelts) returning from fresh water to sea water, osmoregulate with difficulty or not at all. (From auth. summ.)

4482. Konishi, Jihei, and Yngve Zotterman. 1961. FUNCTION OF TASTE FIBRES IN THE CARP. Nature, Vol. 191, No. 4785, pp. 286-287.

A comparison of the chemoceptive response of the palatal nerves with that from the nerves innervating the lips, the barbels and the gill rakers gives us the impression that the palatal nerves are the most important taste nerves of this species.

4483. Nandi, Jean. 1961. NEW ARRANGEMENT OF INTERRENAL AND CHROMAFFIN TISSUES OF TELEOST FISHES. Science, Vol. 134, No. 3476, pp. 389-390.

An unusual morphologic arrangement of interrenal and chromaffin tissues has been observed in two families of teleost fishes. In most teleosts in which these cell types occur together in association with the postcardinal veins and their branches, the chromaffin cells are located between the lumen of the vein and the interrenal cells. This typical relationship is reversed in some of the Labridae and Scaridae. (Auth. abst.)

4484. Haines, Donald A., and Reid A. Bryson. 1961. AN EMPIRICAL STUDY OF WIND FACTOR IN LAKE MENDOTA. Limnology and Oceanography, Vol. 6, No. 3, pp. 356-364.

Wind blowing across a water surface will transmit momentum to the water and cause a surface current. The ratio of water velocity to wind velocity is called the wind factor. This paper presents observed values of the wind factor obtained as median values and by regression analysis of wind velocity vs. water velocity. The data show that the wind factor is a discontinuous function at a critical wind speed. Water velocity in the surface layers increases with wind velocity until a critical wind speed is reached, and then it decreases. This observation is in agreement with Munk's (1946) theory of a critical wind speed for air-sea boundary processes, which yields air-sea boundary instability for winds exceeding 6.5 m/sec. The observations taken in Lake Mendota yield a critical wind speed of 5.7-6.1 m/sec. The present results were arrived at after a study of 356 observations. (Auth. abst.)

4485. Shulman, Mark D., and Reid A. Bryson. 1961. THE VERTICAL VARIATION OF WIND-DRIVEN CURRENTS IN LAKE MENDOTA. Limnol-

ogy and Oceanography, Vol. 6, No. 3, pp. 347-355.

The deviation of wind-driven water currents from wind direction was examined as a function of depth in Lake Mendota utilizing the free-drag method. The mean vector hodographs were obtained for various wind velocities. The relation of wind velocity to angular deflection was also obtained.

The depth of frictional influence was empirically determined to be between 2 and 3.5 m and an improved relationship with wind speed was developed.

Wind stress on the water surface was calculated by fitting Ekman and Rossby spirals to the hodographs and intergrating the cross-wind component from the surface to depth D. The proportionality of the stress to the wind velocity was determined and comparisons made with previous computations. (Auth. abst.)

4486. Heron, J. 1961. THE SEASONAL VARIATION OF PHOSPHATE, SILICATE, AND NITRATE IN WATERS OF THE ENGLISH LAKE DISTRICT. Limnology and Oceanography, Vol. 6, No. 3, pp. 338-346.

A record is presented of two years continuous observations, from January 1958 to March 1960 of the north and south basins of Windemere, Esthwaite Water, and Blelham Tarn. The changes in phosphate concentration together with data for silicate and nitrate are shown. Rainfall, temperature, and total diatom population are also included. An improved method for the determination of phosphate has made possible the recognition of a vernal decline and subsequent autumnal increase in the concentration of this constituent. The changes in the chemical composition of the water are attributed to the influence of conditions in the catchment area rather than changes in the lake itself. (Auth. abst.)

4487. Hobbie, John E. 1961. SUMMER TEMPERATURES IN LAKE SCHRADER, ALASKA. Limnology and Oceanography, Vol. 6, No. 3, pp. 326-329.

Lake Schrader is a deep arctic lake on the northern slope of the Brooks Range, Alaska, at a latitude of 69°N. Field investigations covered two summers, the warm summer of 1958 when the ice cover lasted until June 28, and the cool summer of 1959 when the ice left the lake on July 26. Thermal studies revealed that the lake developed and maintained a stable stratification between 4.5 and 10.5° C in 1958 but did not reach 4°C by mid-August, 1959.

4488. Yount, James L. 1961. A NOTE ON STABILITY IN CENTRAL FLORIDA LAKES WITH DISCUSSION OF THE EFFECT OF HURRICANES. Limnology and Oceanography, Vol. 6, No. 3, pp. 322-325.

Limnological data are presented that indicate that central Florida lakes in summer normally do not overturn at night even though night temperatures are lower than that of the bottom water during the day. This is attributed to the usual lack of wind at night. Wind and rain effects on these shallow lakes are shown before and after tropical storm "Brenda" and hurricane "Donna." It is concluded that the relatively mild Brenda was as effective in initiating overturn as was the much stronger Donna. (Auth. abst.)

4489. Ichiye, Takashi, and Meredith L. Jones. 1961. ON THE HYDROGRAPHY OF THE ST. ANDREW BAY SYSTEM, FLORIDA. Limnology and Oceanography, Vol. 6, No. 3, pp. 302-311.

The St. Andrew Bay System consists of four coastal plain estuaries of positive type. Temperature, salinity, and currents were observed over 24 hr. for five to seven stations in the estuaries which were occupied five times in different seasons. At the two innermost stations, in the northern estuaries, the influence of drainage is strongest and the average salinity is low. There is almost no seasonal trend in average salinity or in the stratification of temperature and salinity. Tidal currents in the bays are predominantly diurnal, corresponding to tidal waves which enter the central bay through two passes. Surface currents often indicated longer duration of ebb than of flood stage, owing to the effect of drainage. Salinity change at the surface and bottom is caused primarily by the advective effect of currents, while in the mid-depths, salinity change showed a trend of continual decrease during 24 hr., instead of a periodic change owing to persistent ebb currents. Bottom salinity, however, usually changed periodically or was almost constant, even at these stations. In one survey, surface salinity showed a trend of increase, owing to persistent flood currents caused by winds. Salinity change at a station in a narrow pass was most sensitive to change of currents. An equation which postulates that the change of salinity during one tidal period is proportional to mean horizontal gradient of salinity and mean current is tested by several examples. Vertical stability is largest at two innermost stations and shows no seasonal trend, as is often observed in other estuaries and in the open sea. (Auth. abst.)

4490. Saila, Saul B. 1961. A STUDY OF WINTER FLOUNDER MOVEMENTS. Limnology and Oceanography, Vol. 6, No. 3, pp. 292-298.

Some aspects of the movements of the winter flounder Pseudopleuronectes americanus (Walbaum) were studied by means of tag-recovery data. No gear selectivity by sex was demonstrated by recaptured fish nor was any association found between the size of the individual and distance of recapture from the release site. An analysis of the movements of tagged individuals away from the breeding area indicates some movement to the east of the release point but this may be due to unequal fishing effort. An attempt is made to explain the return of winter flounder to the coast by means of random search postulating the presence of a reflecting barrier. (Auth. abst.)

4491. Colton, John B., Jr., and Robert F. Temple. 1961. THE ENIGMA OF GEORGES BANK SPAWNING. Limnology and Oceanography, Vol. 6, No. 3, pp. 280-291.

The drift of bottles and transponding drift buoys over the Georges Bank area show that, with the exception of midsummer when the Georges eddy is most pronounced and southerly winds predominate, surface drift is offshore in the direction of the slope water band. Indications are that the currents below the surface move at a slower rate than at the surface, but in a similar direction. The effects of offshore drift, time and location of spawning, vertical distribution of eggs and larvae, and length of pelagic life on the dispersal and survival of eggs, larvae, and juveniles of commercially important foodfishes are discussed. It appears from observations on haddock and herring that under average conditions most fish eggs and larvae are carried away from Georges Bank and lost to the fishery, that only under unusual hydrographic conditions are the eggs and larvae retained in the area, and that the year class strength of the various species inhabiting Georges Bank is dependent in part upon non-tidal drift. (Auth. abst.)

4492. Lackey, James B. 1961. BOTTOM SAMPLING AND ENVIRONMENTAL NICHES. Limnology and Oceanography, Vol. 6, No. 3, pp. 271-279.

Sampling different environments at the bottom level in marine waters indicates that areas of small extent may have very different biotas, both as to component species, and as to total numbers. In fine particle (mud) bottoms, the algae and protozoa are concentrated in the 2 to 5-mm mud-water interface. In sand at the tide line, they are concentrated at somewhat deeper levels. If the bottom is anaerobic the biota is characterized by sulfur bacteria, certain colorless euglenids and ciliates. In aerobic bottom areas, this work indicates a smaller, less extensive biota. The amount of sampling, however, was not sufficient to make this a conclusion.

In the mud-water interface of 5 aquaria where H_2S reached the surface in small patches, there was a larger and more varied population than in non-sulfurous mud a few centimeters away. It is apparent that microclimatic factors are responsible for large biotic differences within short linear distances, and that one should sample benthic populations in an undisturbed mud-water interface. Either a large area should be sampled, or many core samples should be taken, the latter method being preferable. (Auth. abst.)

4493. Wilson, Ronald F. 1961. MEASUREMENT OF ORGANIC CARBON IN SEA WATER. Limnology and Oceanography, Vol. 6, No. 3, pp. 259-261.

An apparatus and procedure for precise measurement of organic carbon in sea water is described. The method, sensitive at $<$ 1 mg/L, entails wet combustion of 200-ml samples of sea water and infrared CO_2 analysis. (Auth. abst.)

4494. McAllister, C. D., T. R. Parsons, K. Stephens, and J. D. H. Strickland. 1951. MEASUREMENTS OF PRIMARY PRODUCTION IN COASTAL SEA WATER USING A LARGE-VOLUME PLASTIC SPHERE. Limnology and Oceanography, Vol. 6, No. 3, pp. 237-258.

A free-floating 20-ft diameter thin transparent sphere, with its center 5.5 m below the sea surface, was filled with nutrient rich water filtered free from plants and animals and inoculated with a natural population of coastal phytoplankters. The resulting phytoplankton "bloom" was then studied in this well-mixed water mass under near-natural conditions of temperature and illumination with the minimum of complications arising from grazing, sinking or lateral transport of the plant cells.

Daily measurements were made of temperature, light and photosynthesis and the water was analyzed for oxygen, carbon dioxide and all common micronutrients. The production of plant material was followed by cell counts and pigment values and by analyses for particulate carbon, nitrogen, phosphorus, carbohydrate, protein and fat.

The results have a bearing on nearly all aspects of marine primary productivity and are discussed in detail. In particular, the growth kinetics and chemical composition of a natural mixed crop have been related to the environment with the minimum of ambiguity. Growth was finally limited by nitrogen deficiency, although the plant biomass nearly doubled after nitrate became depleted, with a shift of metabolism to carbohydrate and fat synthesis. The composition of the plankton at various stages in a bloom is summarized by ratios involving carbon and chlorophyll a.

Differences between the results for photosynthesis obtained by the oxygen and C^{14} method have emphasized the importance of knowing photosynthetic quotient values and possible unlabeled sources of plant carbon. During an initial period of low illumination there was strong evidence for heterotrophic growth. (From auth. abst.)

4495. Wright, John C. 1961. THE LIMNOLOGY OF CANYON FERRY RESERVOIR. IV. THE ESTIMATION OF PRIMARY PRODUCTION FROM PHYSICAL LIMNOLOGICAL DATA. Limnology and Oceanography, Vol. 6, No. 3, pp. 330-337.

Biological rates of oxygen production and consumption were computed by adding the rates of turbulent transport of oxygen to the observed rates of change in concentration at successive depths. This involved using coefficients of vertical eddy diffusivity which were assumed to be equivalent to coefficients of vertical eddy conductivity, computed on the basis of a heat transport equation utilizing Birgean heat budgets. An attempt was made to assess the validity of the coefficients as follows. In the clinolimnion, the average values of the coefficients were similar when computed either on the basis of temperature change with depth and time or on the basis of the heat transport equation. A satisfactory correlation was obtained between the coefficients and a function of shearing stress (velocity gradient) and resistance to mixing (stability). The coefficients decreased with increasing depth in the epilimnion, became minimal and constant in the metalimnion and increased in the hypolimnion. Oxygen consumption exceeded oxygen production below 5.5 m and was maximal just below

the euphotic zone (9-12 m). Oxygen consumption was minimal in the metalimnion and increased in the hypolimnion. An oxygen concentration maximum was correlated with the metalimnetic oxygen consumption minimum. Euphotic zone oxygen production equivalent to dysphotic zone oxygen consumption amounted to 1.01 g O_2/m^2/day. Euphotic zone respiration would have been 1.21 g O_2/m^2/day if it proceeded at the same rate as in the 9- to 12-m stratum. On the basis of the ratios, oxygen consumption/chlorophyll and oxygen consumption/seston euphotic zone respiration amounted to 1.44 g O_2/m^2/day and 2.01 g O_2/m^2/day respectively. Gross production values then would range between 2.22 g O_2/m^2/day and 3.02 g O_2/m^2/day. The latter value was extremely close to black and clear bottle estimates of 3.00 g O_2/m^2/ day. (Auth. abst.)

4496. Megard, Robert O. 1961. THE DIEL CYCLE OF STRATIFICATION AND PRODUCTIVITY IN TWO LAKES OF THE CHUSKA MOUNTAINS, NEW MEXICO. The American Midland Naturalist, Vol. 66, No. 1, pp. 110-127.

Deadman and Whiskey lakes are shallow lakes having abundant rooted vegetation. They are located on the flat, rolling crest of the Chuska Mountains. The vertical plant stems and thermal density strata inhibited turbulence in the water columns of these lakes so that a discrete trophogenic zone developed each day during photosynthesis. This stratification was disrupted by descending density currents when the surface water was cooled each evening.

Because the daily stratification inhibits chemical interchange between the trophogenic zone and the tropholytic zone adjacent to the sediments, the rate of net productivity can be estimated from measurements of the diurnal accumulation of oxygen in the trophogenic zone. The mean rate of net oxygen production derived from three 20-hour studies of the cycle of stratification was 364 mg/m^2/hr, indicating that the net productivity among the rooted plants in these lakes is on the order of 1 g carbon/m^2/day. (Auth. abst.)

4497. Watson, D. G., J. J. Davis, and W. C. Hanson. 1961. ZINC-65 IN MARINE ORGANISMS ALONG THE OREGON AND WASHINGTON COASTS. Science, Vol. 133, No. 3467, pp. 1826-1828.

The concentration of zinc-65 in marine animals and plants near the mouth of the Columbia River is presented. Amounts of radiozinc found in the biota diminished rapidly with the distance from the river mouth. The highest levels were found in plankton, algae, and mollusks. Of the human foods, oysters exhibited the highest levels. (Auth. abst.)

4498. Bai, P. Ambuja, and M. Kalyani. 1961. STUDIES ON THE ASCORBIC ACID CONTENT OF FISH TISSUES---II. Journal of the Zoological Society of India, Vol. 12, No. 2, pp. 216-219.

The ascorbic acid values differ in the different tissues in the three species studied. Haurowitz (1959) points out that it has been suggested by several investigators that ascorbic acid is involved in oxidation reduction processes probably acting even as a catalyst or a coenzyme. But very little is definitely known regarding the metabolic reactions for which ascorbic acid is necessary. It is difficult, therefore, to interpret in precise terms the differences in the ascorbic acid levels in the different tissues, and state how far they reflect metabolic differences. (Auth. concl.)

4499. Sathyanesan, A. G. 1961. CORRELATIVE CYCLICAL CHANGES IN THE PITUITARY AND GONADS OF MYSTUS SEENGHALA (SYKES) AND BARBUS STIGMA (CUV. AND VAL.) Journal of the Zoological Society of India, Vol. 12, No. 2, pp. 175-190.

The terminology of the components of the pituitary of teleosts is reviewed.

The general morphology and histology of the pituitary of Mystus seenghala and Barbus stigma are described.

The ubergangsteil is the component of the pituitary which exhibits qualitative and quantitative seasonal variations that are correlated with the different growth phases of the gonads in both species.

The occurrence of granules, globules, liquified cytoplasmic content, and the total disintegration of chromophils resulting in the formation of colloid-like matter are considered as signs of secretory activity. (Auth. summ.)

4500. Shephard, David C. 1961. A CYTOLOGICAL STUDY OF THE ORIGIN OF MELANOPHORES IN THE TELEOSTS. The Biological Bulletin, Vol. 130, No. 2, pp. 206-220.

In this study, three species of fish which differ in the developmental histories of their pigment cells have been used - the zebra fish (Brachydanio rerio), the cunner (Tautogolabrus adsperus), and Fundulus heteroclitus. Their melanophores have been studied with respect to their origins and subsequent histories, including some of the cytological events occurring during differentiation.

In the teleosts, the neural crest has been identified as the tissue connecting the neural keel with the overlying ectoderm. During development, this tissue loosens, and the cells migrate from this region. In some of these cells melanogenesis has already begun.

Differentiated melanophores are demonstrated in the neural crest of the cunner embryo well before migration occurs.

It is concluded that the normal embryonic pigment of the teleosts has its origin in the neural crest, as in other vertebrates.

In some fish, notably in Fundulus, the pigment cells of the yolk sac are not of neural crest origin. Instead they appear to arise from the extra-embryonic germ ring. These cells may be identified on the yolk sac several hours before there is histological evidence of crest migration.

Many of the cytological aspects of differentiation are similar in the melanophores, regardless of their site of origin. (Auth. summ.)

4501. Koppe, R. 1961. EIN BEITRAG ZUR TOXIKOLOGIE DES TOXAPHENS GEGENUBER FISCHEN UND DEREN NAHRTIEREN SOWIE DIE WIRKUNG BEREITS DURCH TOXAPHEN BEGIFTETER NAHRTIERE UND FISCHE. Zeitschrift Fur Fischerei Und Deren Hilfswissenschaften, Vol. IX, Nos. 7-10, pp. 771-794.

Numerous aquarium experiments were made with various fresh-water fish (Cyprinus carpio, Tinca vulg., Carassius vulg., Leuciscus rutilus, Perca fluv., Gobio fluv.) and some food animals (Gammarus pulex, Asellus aq., Daphina sp., larvae of Corethra plumicornis, Enchytracen) to examine the poisonous effect of a given amount of toxaphene and γ-HCH. With fish the course of poisoning is characterized by intoxication stages. All fish treated proved extremely sensitive to the smallest amounts (0, 001-0, 05 ppm). Carp and crucian carp are most resistant as compared to other fish. As compared with γ-HCH, toxaphene has about the 10-fold effect on fish. The temperature affects the duration of the course of poisoning but not the lethal dose. The fish could recover in poison-free water when they had only been in short contact with lethal doses.

Food animals are generally resistant to toxaphene (particularly Enchytraeen and Corethra larvae). Feeding experiments with poisoned food animals showed that the fish stopped feeding when small damages occurred and recovered thereafter. Fish exposed to sublethal doses or weakened by parasites were usually killed by feeding on poisoned food animals.

Two field experiments conducted at different seasons confirmed largely the results obtained in the aquarium experiments. (Auth. summ.)

4502. Darken, Marjorie A. 1961. APPLICATIONS OF FLUORESCENT BRIGHTENERS IN BIOLOGICAL TECHNIQUES. Science. Vol. 133, No. 3465, pp. 1704-1705.

The visual labeling of various microorganisms has been accomplished with specific fluorescent ultraviolet-absorbing compounds that not only have been bound by the cell but have been transferred by it to subsequent growth. The possibility of application to genetic studies is suggested. (Auth. abst.)

4503. Enomoto, Noriyuki, Tadaaki Nagao, and Yukio Tomiyasu. 1961. STUDIES ON THE EXTERNAL MUCOUS SUBSTANCE OF FISHES--III. IDENTIFICATION OF AMINO ACIDS IN THE MUCOUS PROTEIN FROM SOME FISHES BY PAPER CHROMATOGRAPHY. Bull. Jap. Society of Scientific Fisheries, Vol. 27, No. 2, pp. 143-146.

Amino acid pattern in acid hydrolyzate of the protein from the external mucous substance of 11 kinds of fishes (2 fresh water and 9 sea water fishes) was examined by paper chromatography. All the samples tested gave 16 spots of amino acids and 1 spot of unknown substance with ninhydrin (Fig. 1). As shown in Table 1, in which relative amounts of amino acids estimated roughly from the area and the color intensity of the slots are given, the mucous protein of these fishes seemed to be quite similar in amino acid composition except Dasyatis akajei, the protein of which differed considerably from that of the others, being poorer in leucine, alanine, phenylalanine and arginine, and richer in threonine. Raja hollandi was different from Dasyatis akajei in the amino acid composition, the former being rather similar to teleosts although they are both Elasmobranch fishes. (Auth. abst.)

4504. Berner, Meinhild. 1961. UNTERSUCHUNGEN UBER DEN DORSCHBESTAND (GADUS MORHUA L.) DER BORNHOLM - UND ARKONASEE IN DEN JAHREN 1953-1955. Zeitschrift Fur Fischerei Und Deren Hilfswissenschaften, Vol IX, Nos. 7-10, pp. 481-602.

In the present paper the manifold relationships between the spawning biology of the Bornholm codfish (Gadus morhua) and the seasonal course of practical fishery are demonstrated and it has been shown how the choice of the fishing grounds, the yields, the size and age composition of the catches and their quality are largely conditioned and determined throughout the year by the spawning cycle. Irrespective of the seasonal changes it can be perceived that the productivity of a population is dependent upon other factors, namely upon the number of progenies, the increment of age groups, and the natural mortality and fishing rate. Therefore, further examinations of the growth and life cycle with their biological and fishery effect as well as of the population changes during the last years and the influence on cod yields are intended. (Auth. summ.)

4505. Margalef, Ramon. 1961. COMMUNICATION OF STRUCTURE IN PLANKTONIC POPULATIONS. Limnology and Oceanography, Vol. 6, No. 2, pp. 124-128.

Two alternative approaches are usual in the study of ecosystems. One emphasizes biomass and production and deals with the system in terms of matter and energy; the other is more concerned with structure. Both approaches are complementary and for their synthesis we need quantitative expressions for structure and for structure transmission along time. Information theory can be helpful. Biotic diversity is an expression of the capacity for carrying information of the ecosystem (= "channel width") at the level of individuals. Diversity can be appreciated also at other levels, e. g., at the biochemical level (pigment composition of phytoplankton). Many factors, in planktonic communities chiefly turbulence of water, introduce an amount of noise. Ecosystems can accumulate "history" or increase maturity - succession - only if "noise" remains relatively low. As changes in the energy flow across the ecosystem are related to diversity, this is an area where the study of relations between mass, energy and structure may be rewarding. (Auth. abst.)

4506. Gunter, Gordon. 1961. SOME RELATIONS OF ESTUARINE ORGANISMS TO SALINITY. Limnology and Oceanography, Vol. 6, No. 2, pp. 182-190.

Hypersalinities are not common in the sea, but where such areas are found on certain coasts, high salinities also limit biotic distributions. The endemic fauna of estuaries is largely sessile. There are a few endemic motile species, chiefly fishes and crustaceans, but the motile fauna is made up mostly of the young of species which spawn offshore in high salinity water and these are sometimes present in vast hordes. Examples are menhaden, mullet, croakers, blue crabs and penaeid shrimp, which all support major fisheries in the United States. Estuaries may be characterized as nursery grounds. They are not refuges for spent races. There are three known types of biological gradients that correspond with salinity gradients. Sessile or only slightly motile marine organisms have optimal salinity ranges for best growth and when the salinities vary away from the optima, either upward or downward, the populations become stunted. A second correlation is between the size of motile organisms and the salinity. In general the smaller and younger ones initially distribute themselves in lower salinity water and migrate towards the sea as they grow larger; thus, the correlation between salinity and size is direct. This correlation is probably dependent upon intrinsic physiological conditions, but more information is needed. The greatest numbers of species of marine plants and animals are found in the photic zone of the shallow sea in full sea water and not in estuaries, as has sometimes been stated. All marine organisms and most estuarine organisms can withstand full sea water, but some of them cannot withstand lowered salinities and thus the species numbers decline with the salinity gradient decline in estuaries. The same thing is noted with the salinity gradient rise in hypersaline areas. The reasons for this situation are not clear, but it shows similarities to the warm to cold decline in numbers of species, away from the tropics, which holds both on land and in the sea. This temperature-species gradient has been explained on the basis that the colder regions of the earth are relatively new and organisms have not yet had time to populate them fully. That explanation is probably not valid, for a parallel situation holds over shorter distances in estuaries, which are not new in terms of the Earth's history. (Auth. abst.)

4507. Schoettger, Richard A., and John R. Olive. 1961. ACCUMULATION OF TOXAPHENE BY FISH-FOOD ORGANISMS. Limnology and Oceanography, Vol. 6, No. 2, pp. 216-219.

Single, sublethal dosages of toxaphene are inadequate to produce accumulations in fish-food organisms which cause mortalities among the test fish. It is possible that dosages of this nature are detoxified before they can be accumulated or that they are detoxified below a threshold of accumulation. On the other hand chronic dosages may keep pace with the detoxification rate in laboratory aquaria and permit the accumulation of toxaphene by Daphnia and periphyton. It is probable that the latter dosages simulate the detoxification of waters which were heavily treated with toxaphene. (Auth.)

4508. McNeil, P. L., Jr. 1961. THE USE OF BENZENE HEXACHLORIDE AS A COPEPODICIDE AND SOME OBSERVATIONS ON LERNAEAN PARASITES IN TROUT REARING UNITS. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 127-133.

In the 2-year period after discovery of the presence of a parasitic copepod, referable to Lernaea cyprinacea (Linn.) or L. carassii Tidd, losses of rainbow trout (Salmo gairdneri) increased progressively. The lernaeids observed in the present study consisted only of maturing females attached to the host and ranging in size from 7.5 to 22.5 mm (including the egg sacs). The density of parasites per trout ranged from 1.4 in March to 9.5 in June. Parasite attachments to the gill arch severely affected the gill filaments and the lamellae. Examination revealed the presence of bacterial gill disease, a secondary infection resulting from copepod irritations.

Benzene hexachloride was applied to the parasite-infested ponds by dripping a concentration of 1:10,000,000 directly into the incoming water supply. After 4 months of intensive lindane treatments, 55% of the female copepods had succumbed. Lindane at a concentration of 5 ppm was ineffective in the sterilization of the infested rearing units. One year after the complete hatchery sterilization no sign or symptoms of the parasites could be found. (Auth. abst.)

4509. Lewis, William M., and Michael Bender. 1961. FREE-LIVING ABILITY OF A WARM-WATER FISH PATHOGEN OF THE GENUS AEROMONAS AND FACTORS CONTRIBUTING TO ITS INFECTION OF THE GOLDEN SHINER. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 124-126.

The bacterial genus Aeromonas contains some important pathogens of warm-water fishes. One of the pathogens was present in a free-living state in 4 farm ponds and 36 ponds of 2 different minnow hatcheries. It was concluded that since the pathogen is free-living and apparently widespread, there is no value in attempting to avoid pond-to-pond contamination. It was demonstrated that mechanical damage and crowding of fish are principal factors in producing infection by Aeromonas. (Auth. abst.)

4510. Minckley, W. L., and James E. Craddock. 1961. PREDATION OF CRAYFISH ON FISHES. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 120-123.

Four instances of active predation of crayfishes (Cambarus bartoni and Orconectes nais) on fishes are described. Three of the observations were made after collecting procedures had incapacitated the fishes to a certain extent, and one occurrence of predation on healthy young-of-the-year fish was recorded. Crayfish may be a major factor limiting the pickup of fish after rotenone and shocking operations. The attack behavior may be instigated by visual perception or by perception of chemical substances given off by injured or excited fish. (Auth. abst.)

4511. Snieszko, S. F. 1961. MICROHEMATOCRIT VALUES IN RAINBOW TROUT, BROWN TROUT, AND BROOK TROUT. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 114-119.

Hematocrit values were determined in a large number of rainbow (Salmo gairdneri), brown (Salmo trutta), and brook trout (Salvelinus fontinalis) of various age groups and both sexes. The fish were at hatcheries distributed over a large area and were exposed to different conditions and feeding.

The mean hematocrit values were lowest in the brown trout and highest in the rainbow trout. In sexually mature trout, the hematocrit values were significantly higher in male fish. It is believed that the data here presented will help to establish normal values for trouts. (Auth. abst.)

4512. McCrimmon, H. R., and A. H. Berst. 1961. THE NATIVE FISH POPULATION AND TROUT HARVESTS IN AN ONTARIO FARM POND. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 106-112.

Findings are presented on the dynamics of a fish population currently maintained by natural reproduction in a 1.6-acre stream-pond unit. The standing population of fish in October 1960, was found to be 475.8 lbs. per acre and was composed of brook trout (Salvelinus fontinalis), rainbow trout (Salmo gairdneri), white sucker (Catostomus commersoni), and slimy sculpin (Cottus cognatus). An analysis is made of the stocking, harvest, and exploitation statistics of the trout population for the 1951-60 period, with particular reference to the relation of fishing quality to the standing population in 1960. (Auth. abst.)

4513. Kingsbury, O. R. 1961. A POSSIBLE CONTROL OF FURUNCULOSIS. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 136-137.

It is possible that the occurrence of furunculosis may be correlated with stress caused by a lack of available oxygen. Unfavorable temperature and oxygen content of the water supply seem to be associated with severe outbreaks of the disease. In some hatcheries where the available oxygen has been increased, outbreaks have been eliminated; in other such hatcheries, the outbreaks have been reduced. (Auth. abst.)

4514. Geibel, G. E., and P. J. Murray. 1961. CHANNEL CATFISH CULTURE IN CALIFORNIA. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 99-105.

Culture of channel catfish has been successfully accomplished during the years 1958-60 in a California State hatchery. For brood stock, wild fish were trapped in the Sacramento River and Sutter Bypass. The present 320 brood fish, ranging in size from 3 to 15 lbs., are kept in three separate ponds and spawn at their own choice, without pens. Spawning containers are 10- and 15-gal. milk cans and sections of terra cotta pipe, all painted with black asphaltum paint. The 15 to 20 containers in each pond are checked every other day by a swimmer using a face mask and a glove. Spawning has taken place from May 11 to July 14. Eggs are removed as soon as found and are placed in wire baskets held in troughs with paddles working over them.

A stock solution of 2 g of malachite green in 1 gal. of water is used to control fungus, and 1-hr. treatments of 2 ppm of PMA are given weekly to control external parasites on the fish held in the troughs and the tanks. Treatment of ichthyophthiriasis in the ponds has not been successful.

The brood stock and fingerlings are fed raw beef liver and standard trout pellets. Transportation of the fingerlings offers no difficulties. (Auth. abst.)

4515. Rucker, R. R. 1961. THE USE OF MERTHIOLATE ON GREEN EGGS OF THE CHINOOK SALMON. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 138-141.

A study was conducted to determine the effect of merthiolate as a disinfectant on green eggs of the chinook salmon (Oncorhynchus tshawytscha). It was concluded that the chemical is safe for use on these eggs. (Auth. abst.)

4516. Buss, Keen, and Howard Fox. 1961. MODIFICATIONS FOR THE JAR CULTURE OF TROUT EGGS. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 142-144.

Improvements in the jar culture of trout eggs are described. Major changes are a closed system of water supply for easier and faster treatment, a measuring device for indicating changes in water flow, a method of checking water circulation, and a better method for holding gravel in the bottom of the jars so that the inlet pipe will not become obstructed. The formaldehyde treatment for control of fungus is briefly described, and a method for floating dead eggs from eyed eggs is reviewed. (Auth. abst.)

4517. Piper, Robert G. 1961. TOXIC EFFECTS OF ERYTHROMYCIN THIOCYANATE ON RAINBOW TROUT. Progressive Fish-Culturist, Vol. 23, No. 3, pp. 134-135.

Toxic effects were observed in rainbow trout (Salmo gairdneri) brood stock fed erythromycin thiocyanate for treatment of kidney disease caused by Corynebacterium (sp). The antibiotic was administered in the food at the rate of 4.5 g of drug per 100 lbs. of fish per day for 21 days. (Auth. abst.)

4518. Branson, Branley A. 1961. THE LATERAL-LINE SYSTEM IN THE RIO GRANDE PERCH, CICHLASOMA CYANOGUTTATUM (BAIRD AND GIRARD). The American Midland Naturalist, Vol. 65, No. 2, pp. 446-458.

The lateral-line system of Cichlasoma cyanoguttatum is similar to that of other perciforms but there are many peculiarities. The tubes of the lateralis scales do not make contact with each other but the innervation of the organs in this part of the system is normal. The external morphology and osteological components of the system are described

in detail and compared with that of serranids and centrachids; the text is copiously augmented with illustrations. The lozenge-shaped canal neuromasts are in general like those of sunfishes but much larger. The sensory cells, unlike most of the cells seen in other fishes, bear multiple sensory hairs. All of the supporting cells penetrate to the free surface of the organ and intercellular bridges connect each with the others, thus forming a kind of syncytium. (Auth. abst.)

4519. Schwartz, Frank J. 1961. FISHES OF CHINCOTEAGUE AND SINEPUXENT BAYS. The American Midland Naturalist, Vol. 65, No. 2, pp. 384-408.

A comprehensive monthly trawl survey of Maryland and Virginia's Sinepuxent and Chincoteague Bays found 65 species of fishes within 40 families and 59 genera currently occupying these two seaside bays. Twenty-three species were new to the fauna which, since 1876, now totals 99 species. Various methods, beach seining, crab potting, hook and line fishing and wire oyster test trays, were employed to capture smaller species. An annotated list of species, as well as comments regarding seasonal population dynamics, size ranges, ecological requirements or preferences, are presented. Fish distributions, hydrographic conditions and invertebrates, mainly crabs, squids and Aurelia illustrate the predominant use of the southern inlet as an avenue of entry into these bays. The establishment of the newer northern inlet at Ocean City, Maryland, has had a profound influence on the hydrography of Sinepuxent Bay. This has resulted in extinction, entry or reduction of various fish species. Little use is made of the northern inlet as an avenue of entry into Chincoteague Bay. The fishes and crabs that do enter Sinepuxent Bay by way of the northern inlet are currently not found beyond the 5-8 mile southward influx of water from that inlet. (Auth. abst.)

4520. Barlow, George W. 1961. SOCIAL BEHAVIOR OF THE DESERT PUPFISH, CYPRINODON MACULARIUS, IN THE FIELD AND IN THE AQUARIUM. The American Midland Naturalist, Vol. 65, No. 2, pp. 339-359.

A glossary of the motor patterns of the desert pupfish is given. Reproductive, territorial and group behavior is analyzed in detail. During the breeding season the female visits the territorial male; rarely, males leave their territories and pursue the females in order to spawn with them. When approached by the male, the female nips the bottom, the male sidles against her, she halts and forms an S-shape, the male S-shapes along side the female and wraps his anal fin around her vent, she jerks releasing an egg, the male jerks fertilizing the egg, and the pair separates.

In a fully developed fight two males approach head on, turn away slightly and stand momentarily eye to eye, advance and arch, give tailbeats, charge at one another, and finally circle head to tail rapidly around one another before separating.

During the spawning season males hold territories, and these sometimes contain sub-territories along the periphery which are held by smaller males. Females were never seen to hold territories under natural conditions.

Female and juvenile pupfish move about in schools and forage in groups. In the cold season the males join the schools. (Auth. abst.)

4521. Hamano, Shigeru. 1961. ON THE SPERMATOZOA AGGLUTINATING AGENTS OF THE DOG SALMON AND THE RAINBOW TROUT EGGS. Bulletin of the Jap. Society of Scientific Fisheries, Vol. 27, No. 3, pp. 225-251.

The supernatant fluid exudated upon immersion of the intact eggs into alkaline distilled water (pH 8.5) at 70°C for one hour and by extraction of the ground eggs with distilled water (pH 7.0) at room temperature for the same length of time, caused an agglutination of the spermatozoa. But such an agglutination of the spermatozoa did not result from treatment of the supernatant fluid with an active carbon nor by dialysis.

The above agglutinative substance showed two peaks of absorption spectrum at 265 mμ and 320 mμ. But these peaks were caused to disappear by treatment of the substance with an active carbon and by dialysis.

The lipovitellin-M/7.5 NaCl prepared from the whole yolk of rainbow trout eggs, caused an agglutination of the spermatozoa, but such an agglutination could not be detected as caused by vitellin-M/7.5 NaCl.

The agglutinative action of a lipovitellin upon the spermatozoa was neutralized by addition of two times volume of levetin-M/7.5 NaCl. But the supernatant fluid exudated as a result of immersion of the intact eggs into alkaline distilled water at 70°C for one hour, could not be obtained even if an addition was made of five times volume of levetin-M/7.5 NaCl. (Auth. abst.)

4522. Morooka, Hitoshi. 1961. DETERMINATION OF SEA-WATER POLLUTION--III. A STANDARD OF POLLUTION CAUSED BY CITY WASTE. Bulletin of the Jap. Society of Scientific Fisheries, Vol. 27, No. 3, pp. 220-224.

In the results of the research, it is confirmed that an area, in which the B.O.I. value is below 1.5 is an unpolluted one. Since the B.O.I. value means the oxygen consumption of microorganism at 30°C in 24 hours and the number of microorganism is equivalent to the number of marine bacteria, the number of microorganism can be calculated by using the value of oxygen consumption of marine bacteria per unit cell, 20.2×10^{-12} mg O_2/cell/hr, which was estimated by ZoBell.

The B.O.I. value of 1.5 corresponds to the number of bacteria, 4×10^5/cc.

A survey was conducted into distribution of pollution in sea water by using surface sea water in Nagasaki Harbor. The largest value was obtained at the innermost of the harbor and the value decreased with the stations toward the mouth of the harbor. Vertically, the B.O.I. value was the largest in the surface

and oxygen content and salinity became larger with depths. This phenomenon is considered to be due to the entrainment of the surface sea-water, which may bring water masses high in oxygen content from the mouth of the harbor. The number of micro-organisms in the water of Nagasaki Harbor was $1 \sim 2 \times 10^6$/cc. This is equivalent to the number of marine bacteria calculated by using B. O. I. value. The number of bacteria in the mud of the sea-bottom of the harbor was 10^9/cc. (Auth. abst.)

4523. Jitts, H. R., and B. D. Scott. 1961. THE DETERMINATION OF ZERO-THICKNESS ACTIVITY IN GEIGER COUNTING OF C^{14} SOLUTIONS USED IN MARINE PRODUCTIVITY STUDIES. Limnology and Oceanography, Vol. 6, No. 2, pp. 116-123.

Liquid scintillation counting methods are described for the determination, with a precision of $\pm 2\%$, of the absolute activities of C^{14} stock solutions to be used in marine productivity studies. The efficiency of a windowless Geiger counter was found to be 58% by counting very thin films of labelled plastic whose absolute activities were then determined by liquid scintillation counting. The zero-thickness Geiger activities of several C^{14} stock solutions were determined with a precision of $\pm 3\%$, and an accuracy of $\pm 5\%$. This method was compared with the method of extrapolating self-absorption curves of $BaC^{14}O_3$ planchets of varying thicknesses. It was found that the self-absorption curve between 0.5 and 6.0 mg/cm^2 conformed equally well to an exponential as to a hyperbolic function. Extrapolation of these functions to 0 mg/cm^2 gave zero-thickness activities 24% and 17% respectively lower than those obtained by the new method described, showing that the self-absorption curve varied considerably from both the exponential and hyperbolic function at thicknesses below 0.5 mg/cm^2. This is attributed largely to back-scattering. Empirical self-absorption curves were found to be unsatisfactory due to the impossibility of preparing planchets of $BaCO_3$ in the critical range of 0 to 0.5 mg/cm^2. (Auth. abst.)

4524. Stross, Raymond G. 1961. TURNOVER TIME AND PRODUCTION OF PLANKTONIC CRUSTACEA IN LIMED AND REFERENCE PORTION OF A BOG LAKE. Ecology, Vol. 42, No. 2, pp. 237-245.

Production of planktonic Crustacea on Peter-Paul Lake, Michigan, was used to determine whether application of hydrated lime enhances output of primary consumers. Production values were calculated from the average time required by the dominant crustacean, Daphnia, to replace its population and from the total biomass contained in a #2-mesh plankton net. Standing biomass was measured for 5 months beginning in May, and turnover time of Daphnia was measured for 86 days of summer.

Turnover times measured during the 3rd summer following the end of lime application were 2.1 weeks for Daphnia longispina, which occupied the treated portion, and 4.6 weeks for D. pulex in the control. Why one population replaced itself in a much shorter time was not determined.

Slightly more crustacean biomass was produced in the treated portion, according to calculations, but only because of the apparently more rapid turnover of the Daphnia population. Standing biomass was roughly half that of the control and was lowest of 3 consecutive summers. Whether production decreased accordingly was debatable because an increase in the proportion of embryos in the Daphnia population could have signaled a compensatory shortening of turnover time.

A change in the age distribution of the Daphnia population and a brief reappearance of a species intolerant to lime treatment were indications of post-treatment regression. There appeared to be, however, no decline in the level of calcium, magnesium or bicarbonate, the major addition products of liming. (Auth. summ.)

4525. Goldman, Charles R. 1961. THE CONTRIBUTION OF ALDER TREES (ALNUS TENUIFOLIA) TO THE PRIMARY PRODUCTIVITY OF CASTLE LAKE, CALIFORNIA. Ecology, Vol. 42, No. 2, pp. 282-288.

The abundance of the mountain alder (Alnus tenuifolia Nutt.) along the east shore of Castle Lake provided an opportunity to evaluate the influence of this nitrogen-fixing terrestrial plant on the primary productivity of the lake.

Total nitrogen content of green alder leaves was appreciably higher than that of other deciduous species. Analyses indicated that the leaf fall from the alders contained over 4 times as much nitrogen as the defoliation from other species.

Soil analyses clearly indicated the accumulation of nitrogen on the alder side of Castle Lake as well as in the lake bottom sediment. Springs draining the east shore also reflected the higher nitrogen levels on the alder side. The measured inflow of organic nitrogen amounted to 15.5% of the lake's average content during the June to October period. Estimates based on evaporation loss and measured outflow of the lake considerably increase this value. A total inorganic nitrogen budget for the lake was estimated.

The greater fertilizing influence of the spring water from the east shore over that collected from the west was demonstrated by bioassay utilizing C^{14}, the natural lake phytoplankton, and filtered spring water as a nutrient additive. In a 2nd experiment the stimulating effect of the east shore spring water on culture growth was doubled after passage through the alder humus.

Simultaneous in situ measurement with C^{14} of photosynthesis in Castle Lake gave further evidence of a significant contribution by alders to the primary productivity of the lake. (Auth. summ.)

4526. Burnet, A. M. R. 1961. AN ELECTRIC FISHING MACHINE WITH PULSATORY DIRECT CURRENT. New Zealand Journal of Science, Vol. 4, No. 1, pp. 151-161.

The electrical constants for fishing with an earth-return system are given. A boat-mounted unit for larger streams is described. It can be used by three operators. Automatic control circuits which give the

maximum safety of operation are described. (Auth. summ.)

4527. Rumyantsev, A. I. 1960. DESTRUCTION OF THE REPRODUCTIVE ORGANS OF HERRING CAUSED BY ULTRASOUND UNDER NATURAL CONDITIONS. Doklady, Vol. 134, No. 4, pp. 955-958; Technical Translations, Vol. 5, No. 10, pp. 540. 1961.

The repeated exposure of herring shoals to ultrasound emanating from fish-detection apparatus in a limited volume of water (20 to 30 square kilometers by 100 meters) is shown to have caused damage to the reproductive organs of the herring, with a substantial reduction from year to year in the size of the shoals.

4528. Liston, John, and Charles R. Hitz. 1961. SECOND SURVEY OF THE OCCURRENCE OF PARASITES AND BLEMISHES IN PACIFIC OCEAN PERCH, SEBASTODES ALUTUS, MAY-JUNE 1959. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 383, 6 pgs.

A brief study was made of the occurrence of parasites and blemishes in the Pacific Ocean perch, Sebastodes alutus, caught in the waters of Hecate Strait and those southward to Cape Blanco, Oregon, to test the findings made during a similar study in 1958. (Auth. abst.)

4529. Schultz, Vincent. 1961. AN ANNOTATED BIBLIOGRAPHY ON THE USES OF STATISTICS IN ECOLOGY--A SEARCH OF 31 PERIODICALS. United States Atomic Energy Commission, Office of Technical Information, TID-3908, 314 pgs.

This bibliography is the result of an extensive literature search for uses of statistics in the fields of wildlife, fisheries, limnological, oceanographic, and related research.

The search was made to obtain historical and current information on the use statistics in these fields of study, as well as to obtain examples, for incorporation into a statistical text for students and research workers in these fields of endeavor.

Thirty-one serial publications were searched page by page for this information. All issues were inspected from the first through the 1958 issues. (From auth. intro.)

4530. Applegate, Vernon C. 1961. DOWNSTREAM MOVEMENT OF LAMPREYS AND FISHES IN THE CARP LAKE RIVER, MICHIGAN. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 387, 71 pgs.

An inclined-screen trap was installed on the Carp Lake River, Emmett County, Michigan, in the spring of 1948 and has been in almost continuous operation since that time. The major goal of this project--a precise determination of the length of the larval life of the sea lamprey--was not attained because of the contamination of the stream above the dam with spawning lampreys. The lampreys and other fishes collected in the trap did, however, provide extensive and valuable biological information. The present report documents much of the information, largely in tabular form, accumulated over the operating seasons, 1948-49 through 1957-58; the amount of detail has been varied according to the importance of the topic under consideration or the amount required to bring out a particular point.

Records given for lampreys include: annual catches of sea lamprey, American brook lamprey, silver lamprey, and of larval lamprey, not fully separated by species, 1948-49 through 1957-58; daily record of catches of recently transformed sea lampreys, water temperature, water level, weather and, for some seasons, information on length, 1951-52 through 1957-58; length-frequency distribution of recently transformed sea lampreys for 8 seasons of the period, 1948-49 through 1957-58; mean weights and ranges of weight of samples of recently transformed sea lampreys in 6 seasons of the period, 1948-49 through 1957-58; trend in the monthly average length of recently transformed sea lempreys, October 1954 through April 1955; semi-monthly totals of catches of larval lampreys (sea lamprey and American brook lamprey, combined), 1948-49 through 1957-58; monthly length-frequency distribution of larval lampreys (same 2 species), November 1949 through June 1950.

Data on other fishes included semimonthly totals of catches of individual species each season 1948-49 through 1957-58; some information was given on lengths. Altogether, 22 species other than lampreys were caught in the traps. (Auth. abst.)

4531. McCammon, George W., and Charles M. Seeley. 1961. SURVIVAL, MORTALITY AND MOVEMENTS OF WHITE CATFISH AND BROWN BULLHEADS IN CLEAR LAKE, CALIFORNIA. California Fish and Game, Vol. 47, No. 3, pp. 237-255.

Huge, underfished stocks of white catfish and brown bullheads exist in Clear Lake. Several possible approaches to more effective management of the stocks are discussed briefly.

4532. Benson, Seth B., and Robert J. Behnke. 1961. SALMO EVERMANNI A SYNONYM OF SALMO CLARKII HENSHAWI. California Fish and Game, Vol. 47, No. 3, pp. 257-259.

After finding a record that cutthroat trout from Lake Tahoe had been planted in the stream from which Salmo evermanni Jordan and Grinnell, 1908, was later obtained, and aware that specimens of evermanni resembled specimens of cutthroat trout from Lake Tahoe, we closely compared the type and two "cotypes" of evermanni with specimens of Salmo clarkii henshawi Gill and Jordan, 1878, from Lake Tahoe to determine if evermanni was actually a distinct form. We found no significant differences in the specimens. It is especially important that they were alike in distribution, size, and shape of the dark spots and in having a high number of gill rakers. These characters distinguish henshawi from other kinds of cutthroat trout. From these circumstances, and because the presence of a cutthroat endemic to the San Bernardino Mountains seems unlikely to us on distributional grounds, we

have concluded that the specimens upon which the name evermanni was based were derived from a plant of cutthroat trout whose origin was Lake Tahoe. (Auth.)

4533. Reish, Donald J. 1961. THE USE OF THE SEDIMENT BOTTLE COLLECTOR FOR MONITORING POLLUTED MARINE WATERS. California Fish and Game, Vol. 47, No. 3, pp. 261-272.

The use and application of a one-gallon jar for monitoring marine areas or outfalls are discussed. The results of a two-year study in different ecological regions of Los Angeles-Long Beach Harbors, California, are presented. The species, the number of species, and some chemical and physical characteristics are related to varying degrees of pollution. The seasonal occurrences of the more prevalent species are discussed. (Auth. summ.)

4534. Young, Parke H. 1961. PARTY BOAT LOGS SHOW HOW SKINDIVERS FARED DURING 1958 AND 1959. California Fish and Game, Vol. 47, No. 3, pp. 303-305.

Abalone were obviously the prime target for most divers. However, speargun experts showed sufficient skill (or luck) and stamina to bring in white seabass, yellowtail, bonito and barracuda. These catch figures indicate there is practically no competition between skindivers and hook and line fishermen.

4535. Reid, Gerald M. 1961. STOMACH CONTENT ANALYSIS OF TROLL-CAUGHT KING AND COHO SALMON, SOUTHEASTERN ALASKA, 1957-58. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 379, 8 pgs.

Stomach samples of king salmon (Oncorhynchus tshawytscha) and coho salmon (Oncorhynchus kisutch) were collected from the commercial troll fishery of Southeastern Alaska in 1957 and 1958.

Herring accounted for the largest percentage of the five organisms eaten most frequently by both species of salmon.

The diet of coho salmon was found to be much more varied than that of king salmon. Differences in the salmons' diet between four geographic areas of Southeastern Alaska and differences occurring in relation to the size of the salmon were analyzed and described. (Auth. abst.)

4536. Suttkus, Royal D., and Bangalore I. Sundararaj. 1961. FECUNDITY AND REPRODUCTION IN THE LARGESCALE MENHADEN, BREVOORTIA PATRONUS GOODE. Tulane Studies in Zoology, Vol. 8, No. 6, pp. 177-182.

Fecundity of the largescale menhaden, Brevoortia patronus, from Louisiana coastal waters was estimated by volumetric method. By actual count, we found 20, 827 and 34, 059 large eggs in the ovaries of each one of age groups I and II. Ovaries of age group II individuals averaged about four cubic centimeters more than the testes of the age group II males from the same spawning mass. Part of the difference in gonad volume was due to the larger average size of the age group II females. The period of the maximum volume of testes and ovaries in addition to texture indicate a spawning peak in January. Age group II individuals make up the major part (about 85 percent) of the spawning population, age group I about 9 percent, and age group III about 4 percent. The short life and early maturity make the largescale menhaden a rapidly renewable resource. (Auth. abst.)

4537. Geagan, Donald W., and Thomas D. Allen. 1960. AN ECOLOGICAL SURVEY OF FACTORS AFFECTING FISH PRODUCTION IN LOUISIANA WATERS. Louisiana Wild Life and Fisheries Commission, Fisheries Section, Dingell-Johnson Project F-6-R Louisiana, 100 pgs.

No chemical or physical characteristics were observed which were lethal to the aquatic community present in the lakes studied. Thermal stratification was observed which could be responsible for the redistribution of aquatic organisms in Cane River Lake, Chicot Lake, and Lake Providence.

Laboratory analyses for available phosphates, total phosphorous, ammonia nitrogen, organic nitrogen, nitrite nitrogen, and nitrate nitrogen were inconclusive. The only correlation found was an inverse ratio of the total phosphorous to the nanno plankton organic material.

Benthos production as indicated by the standing crop is not indicative of the standing crop production of the fish population, although it is of value in indicating fish food preferences and apparent abundance of species according to this preference and the ability of the fish to utilize those organisms which are present.

Adequate abundance of the young of the year of the game species of fish occurred throughout the study.

The total alkalinity and the gravimetric results of the total plankton corresponded directly with the standing crop fish production. These were found to be greatest in the ox-bow, Lake Providence, and the old river, Cane River Lake. The two impoundments were much lower in the standing crop fish production. (Auth. concl.)

4538. Gard, Richard. 1961. EFFECTS OF BEAVER ON TROUT IN SAGEHEN CREEK, CALIFORNIA. The Journal of Wildlife Management, Vol. 25, No. 3, pp. 221-242.

Physical environment of the trout was altered measurably following constuction of beaver dams. Most importantly, the substrate changed from gravel and rubble to silt, water velocities decreased, ice conditions became less severe, and the depth and area of the aquatic habitat increased. Water temperature extremes lessened in the ponds, but water chemistry was little affected.

These changes in physical environment resulted in profound changes in the bottom fauna. Although fewer different kinds of organisms were found to live in pond bottoms, much greater standing crops of organisms were living there than in the stream.

All trout relied heavily on bottom faunas for food. In summer, however, drift organisms also became important. Trout living in the stream ate stream

fauna almost exclusively. Rainbows living in the ponds depended largely on stream organisms for food, but pond brook and brown trout were supported mainly by pond faunas. Foraging was not random; some organisms, though seemingly unavailable, were selected by trout in both habitats.

The higher standing crop of bottom fauna and the unique physical environment in the ponds were reflected in greater trout populations. These in turn resulted in a relatively higher catch in the ponds than in the stream.

A flood in 1955 removed most of the dams in one beaver colony. Following dam removal, there was a substantial decrease in surface area, trout food, and number of trout. Rainbows replaced browns as the dominant species.

Some marked trout crossed up and down over most beaver dams at all seasons. There was no evidence that the barrier influence of dams depressed the level of adult trout populations.

It is concluded that beaver are of substantial benefit to trout in Sagehen Creek. (From auth. summ.)

4539. Patriarche, Mercer H. 1961. AIR-INDUCED WINTER CIRCULATION OF TWO SHALLOW MICHIGAN LAKES. The Journal of Wildlife Management, Vol. 25, No. 3, pp. 282-289.

The feasibility of preventing winterkills of fish by means of circulating water with compressed air was tested in two Michigan lakes at the Rifle River Fisheries Research Station in the winters of 1957-58, 1958-59, and 1959-60.

In 1957-58, an unsuccessful attempt was made late in February to recharge the upper end of Spring Lake with oxygen after the supply was nearly exhausted. Holes were opened up overnight in ice as much as 15 in. in thickness and an open channel, 10 to 21 ft. wide, was maintained.

In 1958-59, operations were started in Loon Lake on December 30, 1958, and a rapid decline in oxygen occurred, halted only by a thaw late in March. Oxygen values as low as 0.4 p.p.m. 2 ft. below the ice were detected. A small winterkill occurred. Temperatures of the water and bottom mud were lowered. A temperature gradient was established in the lake at about the level of the air conductor (8 to 10 ft. deep) above which was a nearly uniform temperature zone of approximately 32° to 34°F.

In 1959-60, a similar downward trend in oxygen developed in Loon Lake despite an earlier start (December 8, 1959) and the suspension of the air conductor at a depth of 5 ft. Doubling the number of apertures failed to halt the oxygen decline. A moderately heavy kill of fish (mostly bluegills) occurred. (Auth. summ.)

4540. Sykes, James E. 1961. CONTRIBUTIONS TO THE STUDY OF CHESAPEAKE BAY STRIPED BASS. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 1-2.

The long-range objectives of coordinated research of the fishery, designed to assess the effects of fishing, are to estimate abundance, mortality rates, and exploitation parts of the striped bass, Roccus saxatilis, in Chesapeake Bay. The first phase, involving the cooperation of biologists of Maryland, Virginia, and the U. S. Bureau of Commercial Fisheries, was a pilot program of systematic tagging and recovery in 1957-8. The nature of further research on striped bass populations in Chesapeake Bay is described.

4541. Lewis, Robert M. 1961. COMPARISON OF THREE TAGS ON STRIPED BASS IN THE CHESAPEAKE BAY AREA. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 3-8.

Petersen disk, nylon streamer, and jaw ring tags were applied to striped bass, Roccus saxatilis, in the Chesapeake Bay area in 1957. The primary objective was to determine the tag most suitable for a study of movement and in estimating population size. Tag return data were analyzed statistically to test comparative merits of tags. Petersen disk tags were returned selectively from gillnets in some size classes of fish as compared to nylon streamer and jaw ring tags. There was little difference in the suitability of jaw ring and streamer tags to requirements of the study. The streamer tag was chosen only because it was easier to obtain than the jaw ring tag. (Auth. abst.)

4542. Mansueti, Romeo J. 1961. AGE, GROWTH, AND MOVEMENTS OF THE STRIPED BASS, ROCCUS SAXATILIS, TAKEN IN SIZE SELECTIVE FISHING GEAR IN MARYLAND. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 9-36.

Scale samples and tag returns were studied from over 1100 striped bass caught in 1957-58 at six locations in the Chesapeake Bay region of Maryland. Most fish, represented by age groups II-IV, were taken in size-selective gillnets and some by hook and line, otter trawls, and haul seines. Known males ranged as follows: age groups-II-XI, fork lengths-13-37 inches; and weights-0.7-25 pounds. Females combined with fish of unknown sex ranged as follows: age groups-I-XIV, lengths-6-42" F. L.; and weights-0.8-49 pounds. Both sexes grew at the same rate during the first three years of life. Beginning with age group IV, the males grew at a consistently lower rate than the females and unknown sex group. Growth calculated from gillnetted fish was slightly higher than normal during the first two years of life, after which there was no apparent difference between selectively and non-selectively caught fish.

Tagging results show that the bulk of the 418 (38 percent) recaptured striped bass remained in the Maryland part of Chesapeake Bay. Three tagged fish were recaptured outside the bay on the Atlantic coast, and two were taken in the Virginia part of the bay. The restricted recaptures around the tagging sites, in spite of time free, suggested that during the first several years of life the movements of local populations are minimal. Data is presented to show that larger striped bass moved greater distances on the average than smaller fish. Some tag returns showed that spawning fish returned to the same spawning site one and two years later. Exchange between

bay and river populations of Maryland striped bass was not very great. New results have strengthened the previous assumption that the Potomac River population may be relatively self-contained, at least during the first three or four years of life. (Auth. abst.)

4543. Massmann, William H., and Anthony L. Pacheco. 1961. MOVEMENTS OF STRIPED BASS TAGGED IN VIRGINIA WATERS OF CHESAPEAKE BAY. Chesapeake Science, Vol. 3, Nos. 1-2, pp. 37-44.

In winter and spring of 1957 and 1958, 2429 striped bass ranging in length from 7 to 35 inches were tagged in the York, James, and Rappahannock Rivers of Virginia and 675 were recaptured. Fish were recaptured by stake, drift, and anchor gillnets, fyke nets, pound nets, hook and line and an oyster dredge. Ninety-four percent of the recaptured fish were taken in the same river system in which they were tagged. Striped bass from the York River moved more extensively than those from the Rappahannock; those from the James River moved least. Twelve fish moved outside of Chesapeake Bay and were recaptured in coastal waters between Maine and North Carolina. Most fish recaptured in fall and winter were taken in the same river system in which they were tagged, while some of those recaptured in spring and summer moved considerable distances. Almost all striped bass less than 12 inches in length remained in the river system in which they were tagged. The distribution of tag returns suggested that subpopulations of striped bass were present in the York and Rappahannock and James Rivers. The James River fish rarely mixed with those from other areas in Chesapeake Bay. (Auth. abst.)

4544. Tagatz, Marlin E. 1961. REDUCED OXYGEN TOLERANCE AND TOXICITY OF PETROLEUM PRODUCTS TO JUVENILE AMERICAN SHAD. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 65-71.

Experiments were conducted on juvenile American shad, Alosa sapidissima, to indicate tolerance to reduced oxygen, toxicity of petroleum products, and toxicity of petroleum products with accompanying low dissolved oxygen. All mortalities in reduced oxygen tests occurred at dissolved oxygen values of less than 2 ppm with lethal concentrations varying with the rate of reduction. No mortalities occurred when dissolved oxygen was maintained between 2 and 4 ppm. TL_m (median tolerance limit) values were determined for gasoline, diesel fuel oil, and bunker oil for 24- and 48-hour periods. Gasoline was the most toxic, fuel oil somewhat less toxic, and bunker oil least toxic. The lethality of petroleum products to shad was found to increase when accompanied by low dissolved oxygen. (Auth. abst.)

4545. Wilber, Charles G. 1961. SOME PHYSIOLOGICAL CHARACTERISTICS OF THE HEART OF THE TOADFISH, OPSANUS TAU. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 72-75.

A study was made of the heart from Opsanus tau using an electrocardiograph to record normal activity and the responses to drugs and to experimental manipulations. Bradycardia occurs in toadfish kept out of water for more than 5 minutes. Large doses of darstine, an atropine-like drug, bring about A-V dissociation and prolongation of conduction time, probably by direct action on the heart muscle. Changes in temperature modify the heart in vitro and in situ. (Auth. abst.)

4546. Massmann, William H. 1961. A POTOMAC RIVER SHAD FISHERY, 1814-1824. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 76-81.

The original record books of George Chapman, Esq., haul seine fisherman for American shad, Alosa sapidissima, in the Potomac River during the period 1814 to 1824, include the numbers of shad and herring, A. aestivalis and A. pseudoharengus, caught and sold each day. From the numerous miscellaneous notes included in the records, estimates of fishing effort were made.

Yearly shad catches ranged from 27, 939 to 180, 755 fish, while the numbers of herring caught and sold ranged from 343, 341 to 1, 068, 932. The estimated catch per haul was 800 shad in late March, 2250 in mid-April, and 1200 per haul in late May. During the 11-year period almost one million shad were taken.

Catches from this fishery were equal to about one-third of the catch of shad by all gears from the Potomac River during a 11-year period (1946-56). Other species were undoubtedly captured, but were not sold. Fishing for shad in the early 1800's was evidently far more lucrative than it is at the present time. (Auth. abst.)

4547. Schwartz, Frank J. 1961. FOOD, AGE, GROWTH, AND MORPHOLOGY OF THE BLACK-BANDED SUNFISH, ENNEACANTHUS C. CHAETODON, IN SMITHVILLE POND, MARYLAND. Chesapeake Science, Vol. 3, Nos. 1-2, pp. 82-88.

A total of 322 specimens of the blackbanded sunfish Enneacanthus c. chaetodon, was collected during two separate drainings of Smithville Pond, on the Coastal Plain, Caroline County, Maryland. Ninety, 30 from the November 1955 and 60 from the July 1958 samples, were examined to ascertain age, growth, body proportions, food and sexual dimorphism. Body proportions approached those noted for the recently described southern subspecies E. c. elizabethae. No morphological or growth differences were found between males and females in either sample. Lengths of 43-53 mm were attained in about four years. Wide differences occurred, between samples, in the calculated lengths for ages 1 and 2 while those for ages 3 and 4 were more similar. Further investigation will determine whether these data exhibit populations which reflect extremes of growth-environment interplay or an unreliability in the scale method of determining age and growth for this species, Chironomids (summer) and caddis fly larvae (fall) were prominent food items. (Auth. abst.)

4548. Pfitzenmeyer, Hayes T. 1961. BENTHIC SHOAL WATER INVERTEBRATES FROM TIDE-WATERS OF SOMERSET COUNTY, MARYLAND. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 89-94.

Forty-one invertebrate species were collected during two surveys of the soft-shelled clam, Mya arenaria, in Somerset County waters of the Chesapeake Bay area. Quantitative samples taken with the hydraulic clam dredge were limited to bottoms in waters between 3 and 9 feet deep. Major bottom types, water temperatures, salinities, and dominant species in each of the twelve sampled areas are presented. The common synapta, Leptosynapta inhaerens, the ornate worm, Amphitrite ornata, and the stout razor clam, Tagelus plebius, were the most abundant and widely distributed species. (Auth. abst.)

4549. Frisbie, Charles M. 1961. YOUNG BLACK DRUM, POGONIAS CROMIS, IN TIDAL FRESH AND BRACKISH WATERS, ESPECIALLY IN THE CHESAPEAKE AND DELAWARE BAY AREAS. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 94-100.

Young black drum, ranging from 15-267 mm, were found in virtually fresh tidal waters (4 out of 86 records), but most often under brackish conditions in the Chesapeake and Delaware Bay areas. The sporadic records indicate that young are relatively uncommon. No relationship was found between size and salinity. Records suggest that Pogonias cromis spawns in offshore waters of the mid-Atlantic Ocean from March to May, and that the Chesapeake and Delaware Bay areas are at the northern limits of the effective spawning range. The larvae probably drift into the estuarine nursery areas thereafter by way of tidal currents, but these may be only a small part of a crop spawned offshore. The young apparently move offshore and perhaps southward again during the late fall. A marked low ratio of records of the young to adults was apparent. Young may be subjected to high mortality from unknown environmental factors; changing low temperatures in spring may be an important one. (Auth. abst.)

4550. Lyman, Henry. 1961. A SIXTEEN POUND PUGHEADED STRIPED BASS FROM MASSACHUSETTS. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 101-102.

A new record of a pugheaded striped bass, Roccus saxatilis, weighing 16 1/4 pounds, is described and illustrated. It was taken by an angler off Nantucket, and resisted capture as a normal fish. It seemed in good condition except for the deformity, and its stomach contained sea herring. (Auth. abst.)

4551. Hoese, H. D., C. E. Richards, and M. Castagna. 1961. APPEARANCE OF THE GAG, MYCTEROPERCA MICROLEPIS, IN COASTAL WATERS OF VIRGINIA. Chesapeake Science, Vol. 2, Nos. 1-2, pp. 104-105.

Eighteen young gag, Mycteroperca microlepis, 61-186 mm F. L., were recorded from Chincoteague Bay, Eastern Shore waters, off Virginia Beach, and within Chesapeake Bay from July to November 1960. Average lengths at progressive collecting periods suggest rapid growth. Corolation and pattern varied somewhat among the specimens. (Auth. abst.)

4552. Anonymous. 1961. 1960 NATIONAL SURVEY OF FISHING AND HUNTING. U. S. Fish and Wildlife Service, Circular 120, 73 pgs.

The National Survey of Fishing and Hunting measures the amount of money and time spent and the number of trips made by American fishermen and hunters to participate in these sports. It shows the number of these sportsmen by households and by their chief social and economic characteristics -- geographic area, population density, age, sex, occupation, and income. In addition, it shows: (1) the number of fresh-water fishermen fishing in man-made ponds and reservoirs, in natural lakes and ponds, and in rivers and streams; (2) the number of salt-water fishermen fishing in the surf, in bays and sounds, in tidal rivers and streams, and in the adjoining sea; (3) the number of hunters who hunt for big game, small game, waterfowl, and mourning doves; (4) the number of ducks bagged, and (5) expenditures on boats and motors and boat launching, automobile expenditures on other types of transportation, other trip expenditures, and daily entrance fees. (Auth.)

4553. Cope, Oliver B. 1961. EFFECTS OF DDT SPRAYING FOR SPRUCE BUDWORM ON FISH IN THE YELLOWSTONE RIVER SYSTEM. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 239-251.

DDT was sprayed at 1 pound per acre from airplanes for the control of spruce budworm on 71,678 acres in the Yellowstone River drainage in 1957. Stream-bottom invertebrates were reduced in number immediately after the spray. Recovery to near-normal total numbers occurred within a year in most streams, but species composition was altered. Drift samples in one stream showed dead and dying invertebrates to be drifting in the current in great numbers. No mortality to fish was found. Chemical analysis showed that DDT up to 0.03 p.p.m. was in several samples of water from streams. In one case a trace was found 55 miles downstream from the spray area. Vegetation samples contained up to 2.3 p.p.m. of DDT. All of the 80 samples of mountain whitefish (Prosopium williamsoni) and rainbow and brown trout (Salmo gairdneri and S. trutta) analyzed contained either DDT up to 14.0 p.p.m. or DDE up to 6.53 p.p.m., or both. DDT was found in trout 85 miles below the spray area, and fish taken more than 2 years after spraying contained DDT. (Auth. abst.)

4554. Shetter, David S. 1961. SURVIVAL OF BROOK TROUT FROM EGG TO FINGERLING STAGE IN TWO MICHIGAN TROUT STREAMS. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 252-258.

Survival of wild brook trout (Salvelinus fontinalis) from the egg to the end of the first summer of life was

investigated at the Hunt Creek Trout Research Station, Montmorency County, Michigan, during 1943-48, by confinement of spawners of known size and number in screened diversions, followed by direct enumeration of the resulting fingerlings. The numbers of eggs deposited were estimated from size of spawners. Percentage survival observed in six diversion experiments ranged from 4.5 to 31.7. Survival from egg to fingerling was estimated also for unconfined, natural populations in the Pigeon River and in Hunt Creek (the natural channel) during 1949-58. Consecutive fall population estimates gave the number of breeders present one fall and the number of fingerlings surviving to the following fall. Egg production for the population of breeders was estimated from egg-count data. From a series of 12 population estimates, survival rates from egg deposition to the following September ranged from 2.7 to 6.7 percent (significantly lower than in the diversion experiments at Hunt Creek). For a total of 24 observations (from confinements in diversions at Hunt Creek and Convict Creek, plus population studies on the Pigeon River and Hunt Creek), the percentage survival from egg to fall fingerling ranged from 2.7 to 43, and averaged 8.6. Excluding what appear to be unduly high results from four of the observations, the survival rates ranged from 2.7 to 8.8 percent (average, 4.7). (Auth. abst.)

4555. von Geldern, C. E., Jr. 1961. APPLICATION OF THE DeLURY METHOD IN DETERMINING THE ANGLER HARVEST OF STOCKED CATCHABLE SIZED TROUT. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 259-263.

Creel-census data from three heavily fished California lakes are used to illustrate a method of determining the proportion of stocked catchable-sized rainbow trout, Salmo gairdneri, taken by anglers. This technique requires the planting of experimental lots of fish marked by the removal of designated fins. A creel checker gathers data used to estimate catch rate and fishing pressure for several days following the experimental plant. These estimates are used to determine a regression line similar to that proposed by D. B. DeLury for fish-population estimates. The regression line is used to make an estimate of the number of fish taken after the census has been terminated. (Auth. abst.)

4556. Katz, Max. 1961. ACUTE TOXICITY OF SOME ORGANIC INSECTICIDES TO THREE SPECIES OF SALMONIDS AND TO THE THREE-SPINE STICKLEBACK. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 264-268.

The toxicity of several organic insecticides to coho (Oncorhynchus kisutch) and chinook salmon (O. tshawytscha), rainbow trout (Salmo gairdneri), and the threespine stickleback (Gasterosteus aculeatus) was determined. Toxaphene, aldrin, dieldrin, DDT, lindane, methoxychlor, heptachlor, chlordane, endrin, Guthion, malathion, Co-Ral, and Sevin were tested. Toxicity was determined at 20° C. in standing water bioassays which lasted 96 hours. Endrin was the most toxic substance tested; the 96-hour median tolerance limit (TL_m) for coho salmon was 0.51 parts per billion. With the exception of Co-Ral and Sevin, the 96-hour TL_m values of all insecticides tested were near 100 parts per billion (0.1 p.p.m.), or much less. The toxicity of the insecticides to threespine sticklebacks in waters of 5 to 25 parts per thousand salinity was not markedly different at the two salinities.(Auth. abst.)

4557. Graham, Richard J. 1961. BIOLOGY OF THE UTAH CHUB IN HEBGEN LAKE, MONTANA. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 269-276.

The Utah chub, Gila atraria, was probably introduced into Hebgen Lake, Montana, in 1935 by bait fishermen. Randomly set gill nets indicate that chubs are concentrated in shallow areas in the spring, widely distributed in the summer and fall, and concentrated in deeper waters in winter. Stomach analyses of 165 chubs collected during the summer of 1948 show that by volume the food was 48.2 percent algae, 21.1 percent higher aquatic plants, and 24.3 percent microcrustaceans. The 209 stomachs taken in 1953-54 contained 36 percent insects, 36 percent microcrustaceans, 19 percent higher aquatic plants, and 9 percent debris. The peak of the spawning season in 1953 and 1954 occurred during late June and early July. Most spawning occurred when water temperatures were above 54°F. Eggs were found on different kinds of bottom, but most were recovered from sand and gravel. The average number of eggs per female was 40,750. Fry occurred along most of the shallow protected shorelines. Fry captured on July 7, 1954, averaged 0.3 inch in total length. Young taken October 1, 1943, averaged 1.3 inches. No mature males less than 3 years old or mature females less than 4 were found. Total lengths for the first 8 years of life were calculated on 475 specimens. (Auth. abst.)

4558. Lewis, William M., Gerald E. Gunning, Edward W. Bonn, and Leon R. Holbert. 1961. FOOD CHOICE OF LARGEMOUTH BASS AS A FUNCTION OF AVAILABILITY AND VULNERABILITY OF FOOD ITEMS. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 277-280.

Under experimental conditions largemouth bass (Micropterus salmoides) used golden shiners (Notemigonus crysoleucas) most heavily as food. Bluegills (Lepomis macrochirus) were used more heavily than green sunfish (Lepomis cyanellus). Green sunfish were chosen over bullheads (Ictalurus melas) and white crappies (Pomoxis annularis). Use of crayfish (Orconectes immunis) was variable, and in some cases they were not chosen at all. Natural-colored goldfish (Carassius auratus) were preferred over gold-colored ones. Green sunfish and bullfrog tadpoles (Rana catesbeiana) were eaten sparingly in comparison to golden shiners. The leopard frog tadpoles (Rana pipiens) were eaten commonly in one comparison with shiners but not at all in another trial. Small bullfrogs were utilized more intensively than shiners in one trial but not eaten in another trial. Utilization of small bullfrogs was variable when accompanied by crayfish; toads were not eaten when fed with leopard frogs. Food items thrown into the tank were usually taken instantly. During a period in the spring bass

ceased feeding or fed very sparingly. The quantity of forage fish eaten daily amounted to 2.2 percent of body weight. (Auth. abst.)

4559. Havey, Keith A. 1961. RESTORATION OF ANADROMOUS ALEWIVES AT LONG POND, MAINE. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 281-286.

From 1950 through 1953, 1,403 to 1,793 near-ripe anadromous alewives, Alosa pseudoharengus, were stocked annually at Long Pond, Hancock County, Maine, to restore an alewife run in the Long Pond drainage. The four stockings produced alewife runs of approximately 11,000 to 51,000 fish in a 3- to 5-year period following each stocking. Later runs (1958-59) produced by progeny of stocked fish were similar to those produced by stocking. There was little relationship between escapement and numbers of progeny 3 to 5 years later. Runs were of age-groups III-VIII but were dominated by age-groups IV-VI. Age-group III appeared in two of the six annual runs and in only one run in significant numbers. Fish of the large 1951 year class appeared in all runs from 1954 through 1959. Older alewives migrated early, but males and females migrated in about equal proportion throughout the run. Body and scale growth was essentially isometric above a body length of about 3.0 inches. Female alewives were significantly larger than males in the Long Pond drainage at ages IV, V, and VI. Fish of given age groups did not fluctuate significantly in size from year to year. Ultimate attainable lengths of male and female alewives determined by the method of Walford were 13.1 and 14.0 inches respectively. The observed sex ratio was 1.28 males to 1.00 female. Sixty-six and one-half percent of age-group V in the run had spawned once and 63.4 percent of age-group VI twice. No fish of age-group III but all of age-group VI had spawned previously. Annual mortalities from age-groups V to VI and from VI to VII were calculated as 78.6 and 74.4 percent, respectively. The post-spawning mortality in Long Pond was 41 percent for age groups combined. (Auth. abst.)

4560. Bonn, Edward W., and Leon R. Holbert. 1961. SOME EFFECTS OF ROTENONE PRODUCTS ON MUNICIPAL WATER SUPPLIES. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 287-297.

Five coves of Lake Lavon and a small lake in north-central Texas were treated with five different rotenone products. Of 18 water tests made before, during, and after treatments, four showed significant change. Turbidity decreased and plankton and bacterial counts increased. The most important change was in taste and odor of treated waters. Rotenone products, such as Noxfish, Chem Fish Regular HFN, and Chem Fish Special HFN, produce undesirable tastes and odors in water. A temporary taste and odor from decomposition of the fish killed can also be expected after treatment. Laboratory tests showed these conditions can be controlled with 1.0 p.p.m. of activated carbon for each threshold odor number produced. Rotenone treatments may cost water plants an additional $60 to $95 per million gallons of water produced during the first few days after application. Rotenone powder and Chem Fish Synergized HFN were the first and second choices for municipal waters because taste and odor problems are reduced and costs are lower. Spring and fall were found the best seasons for municipal lake treatments in Texas. (Auth. abst.)

4561. Hiner, Laurence E. 1961. PROPAGATION OF NORTHERN PIKE. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 298-302.

The procedures and techniques involved in the artificial propagation of northern pike (Esox lucius) at the Valley City, North Dakota, National Fish Hatchery are discussed. Twenty million to 40 million northern pike eggs are taken from wild fish each spring. The eggs are incubated in Downing-type glass jars and the "swim-up" fry are stocked in hatchery ponds at the rate of 100,000 per acre. The use of filtered water for incubation purposes increased the percentage of hatch from 20 percent in 1958 to 78 percent in 1959. Hatchery ponds are filled with water from the Sheyenne River and fertilized 2 weeks prior to the introduction of free-swimming pike. The fry grow to a length of 2-2 1/2 inches over a period of 4-6 weeks in the hatchery ponds. Fingerlings are harvested near the end of their plankton-feeding stage to prevent serious losses for cannibalism. Pond yields vary from 0 to 90,000 fingerlings per acre with an average of 35,000 during the 1959 and 1960 production years. (Auth. abst.)

4562. Qadri, S. U. 1961. FOOD AND DISTRIBUTION OF LAKE WHITEFISH IN LAC LA RONGE, SASKATCHEWAN. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 303-307.

Lake whitefish, Coregonus clupeaformis (Mitchill), of Lac la Ronge, Saskatchewan, were studied from 1948 to 1954. Stomach contents of 1,606 fish from the main lake and 607 from Hunter Bay were analyzed. In the main lake from 40 to 60 percent of the food consisted of chironomid larvae with sphaeriids and caddisfly larvae being other important items. In Hunter Bay amphipods were the chief food and chironomid larvae and sphaeriids shared second place. Abundance and availability of food organisms seemed to determine the type of food utilized. In the early summer whitefish were widely scattered in Lac la Ronge. As the surface water warmed, the fish moved into deeper water apparently responding to temperature changes. In the main lake during July, August, and early September they were concentrated between the depths of 15 and 27 meters. Water temperature ranged from 11° to 14° C. In Hunter Bay during midsummer fish were abundant from 15 to 35 meters where temperatures were usually 8° to 11° C. Whitefish were more active during the night than during the day. (Auth. abst.)

4563. Forney, John L. 1961. YEAR-CLASS DISTRIBUTION OF WALLEYES COLLECTED BY FIVE

TYPES OF GEAR. Transactions of the American Fisheries Society. Vol. 90, No. 3, pp. 308-311.

Year-class distribution of fin-clipped walleyes (Stizostedion v. vitreum) recovered in trap nets during the 1959 spawning run in Oneida Lake was nearly identical to the year-class distribution of marked walleyes released during the preceding 2 years. This indicates trap nets fished during the spawning run took various age groups in proportion to their abundance in the spawning population. Age distributions of mature walleyes taken in the summer and fall of 1958 and 1959 by shocking, trawling, gill-netting, angling, and trap-netting were compared to the age distribution of the 1959 spawning run. Samples taken by shocking, trawling, gill-netting, and summer angling showed about the same age structure as the spawning population. Trap nets fished in the fall and winter ice-fishing appeared to select the older age groups in the population. (Auth. abst.)

4564. Johnson, Fritz H. 1961. WALLEYE EGG SURVIVAL DURING INCUBATION ON SEVERAL TYPES OF BOTTOM IN LAKE WINNIBIGOSHISH, MINNESOTA, AND CONNECTING WATERS. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 312-322.

Survival of naturally spawned walleye (Stizostedion vitreum vitreum) eggs to pre-hatching stage was determined on five bottom areas of Lake Winnibigoshish, Minnesota, and connecting waters over 4 years. These bottom types included soft muck, sand, gravel, rubble, and boulders. Egg sampling was done at intervals throughout the incubation period and estimates of egg abundance made shortly after the completion of spawning and at or near the eyed-egg stage. Initial fertility of walleye eggs was high (96-100 percent), but the percentage of live eggs declined steadily during incubation. During the eyed-egg stage, however, there was an apparent increase in the percentage survival because of disappearance of dead eggs. Egg survival was best on gravel-rubble, both as percentage survival and numbers of eggs surviving the eyed stage. Survival of eggs on improved gravel-rubble bottom was as high as 35.7 percent but on much bottom was as low as 0.6 percent. Survival on better bottoms of gravel and rubble averaged 25 percent. Abundance of eggs on sand bottom to which gravel and rubble had been added was more than 10 times that observed previously, and survival of eggs on the improved bottom increased fivefold. Length of incubation period, which was determined by water temperature, was a factor in egg survival. Walleyes selected gravel bottom for spawning when it was available, and most eggs were deposited in water from 12 to 30 inches deep. Low water levels in the spring of 1958 made much former spawning area unavailable and may have been a factor in a weak 1958 year class. (Auth. abst.)

4565. Mount, Donald I. 1961. DEVELOPMENT OF A SYSTEM FOR CONTROLLING DISSOLVED-OXYGEN CONTENT OF WATER. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 323-327.

A system for controlling the dissolved-oxygen content of a continuous flow of water was developed and tested. It is essentially a continuous flow of water through a partial vacuum. Two daily adjustments maintain the dissolved-oxygen content of the effluent water within 0.05 p.p.m. of the desired concentration. Minimum oxygen content of 0.5 p.p.m. and flow rates greater than 10 liters a minute were obtained. Modifications are suggested to improve the efficiency and capacity of this system. The behavior of four species of fish at reduced oxygen concentrations was observed. When the oxygen content was decreased below 3 p.p.m., ventilation rate and amplitude increased rapidly, activity decreased, normal colors faded, feeding ceased, and the fish became unresponsive to such stimuli as movement and vibration. Oxygen concentrations below 3 p.p.m. appear to be critical for these four species in resting conditions. (Auth. abst.)

4566. Brown, Bradford E. 1961. BEHAVIOR OF SPLAKE AND BROOK TROUT FINGERLINGS. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 328-329.

In these observations domesticated trout behaved exactly as in previous tests carried out by Vincent (1950). Splake, however, showed a contrasting behavior in all trials attempted. In this respect they resembled the wild brook trout observed by Vincent in having a well-developed hiding reaction, a tendency to seek depths and negative phototropism. The latter trait is characteristic of young lake trout reared in New York hatcheries. It is concluded that the responses of this domesticated stock of brook trout relative to these traits were not transferred to the F_1 hybrid. (Auth. concl.)

4567. Eisler, Ronald, and Raymond C. Simon. 1961. DESTRUCTION OF SALMON LARVAE BY HYDRA OLIGACTIS. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 329-332.

Recently hatched larvae of Pacific salmon were exposed to Hydra oligactis for varying lengths of time. Many of the fish exhibited symptoms characteristic of "white spot disease" and usually died within 5 days. Fish were affected adversely by exposures as short as 5 minutes. Increasing abundance of the hydrozoan results in increasing mortality of newly hatched salmon. Fish which had not hatched, and those which had reached later larval stages were apparently unaffected by the presence of these coelenterates. (Auth. summ.)

4568. Bridges, W. R. 1961. DISAPPEARANCE OF ENDRIN FROM FISH AND OTHER MATERIALS OF A POND ENVIRONMENT. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 332-334.

Although the present study was limited in scope and the results may not have universal application, it established the approximate length of time that

endrin remained in the mud, water, fish, and aquatic vegetation under one set of field conditions and, under the same conditions, permitted qualitative observations of the acute toxicity of endrin to fish. (Auth.)

4569. Strawn, Kirk. 1961. GROWTH OF LARGEMOUTH BASS FRY AT VARIOUS TEMPERATURES. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 334-335.

The present study demonstrates that the growth rate of bass fry is retarded at low temperatures and accelerated at high temperatures.

4570. Bates, Daniel W., and Stanley W. Jewett, Jr. 1961. LOUVER EFFICIENCY IN DEFLECTING DOWNSTREAM MIGRANT STEELHEAD. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 336-337.

On the basis of one season's operation of the louver installation at Maxwell Canal, the following conclusions appear warranted: (1) application of louver principles for deflecting downstream migrant steelhead proved successful; (2) a vertical louver installation was very effective in deflecting downstream migrant steelhead; and (3) physical conditions precluded an adequate trial of the efficiency of a horizontal louver installation. (Auth. concl.)

4571. McCombie, A. M. 1961. GILL-NET SELECTIVITY OF LAKE WHITEFISH FROM GODERICH-BAYFIELD AREA, LAKE HURON. Transactions of the American Fisheries Society, Vol. 90, No. 3, pp. 337-339.

The foregoing considerations demonstrate a practical application of gill-net selectivity studies in fisheries management. They indicate the relative efficiency with which the present gear harvests various sizes of whitefish and marked increase in fishing intensity which would probably result from comparatively small reductions in mesh size. Whether changes in mesh size are desirable or not will depend, however, on the particular biological conditions, prevailing in the area under consideration. (Auth.)

4572. Bonn, Edward W. 1961. LAKE TEXOMA WHITE BASS TAGGING STUDY. Texas Game and Fish Commission, Division of Inland Fisheries, IF Report Series--No. 4, 28 pgs.

A tagging study of white bass (Roccus chrysops) on Lake Texoma from November 1954, until December 1959, and 3,254 fish were marked with Petersen disk tags. Both urethane and MS222 were effective sedatives for the fish before attaching the tags with nylon or stainless steel wire. During the five-year period, 348 (10.7 per cent) fish were retaken, with April and May the peak return months each year. Commercial fishermen caught many fish, but were uncooperative in reporting information. Minnows were the bait used for 46 per cent of the returns, while 21 per cent were taken on artificial lures and 20 per cent by nets. The interval of freedom of the tagged fish varied from 0 to 773 days, with 89 days the average. Their movement varied from less than 50 yards to as much as 200 miles up a tributary river, with an average movement of 10.6 miles. The fastest rate of travel was 6.9 miles. The fastest rate of travel was 6.9 miles per day in the river and 3.25 miles in the lake. The most unusual movement was that of fish which traveled through the Denison Dam Powerhouse and were caught from the river below. There appears to be a correlation between the movement of these fish from the lake and the type and amount of water discharged into Red River. In all, 53 fish or 15 per cent of the returns, were caught below the dam after making this unusual trip. There was no indication that fish move into the lake from the river below the dam. Information gained on length and weight of returned fish was not a good indication of the growth of Texoma white bass. Based on a small sample of scale returns, the fish that continued to grow added an annulus some time in late April. Those that did not add a year mark were not free in mid-April or did not increase in size and weight. Recommendations are made to liberalize the regulation for taking white bass and to revise the laws for removing rough fish from Lake Texoma.

4573. Collins, Gerald B., and Carl H. Elling. 1960. FISHWAY RESEARCH AT THE FISHERIES-ENGINEERING RESEARCH LABORATORY. U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Circular 98, 17 pgs.

Results of 4 years of research on fishway problems, data on rates of movement of salmonids ascending fishways, and of spatial requirements of fish are given and experiments to measure fishway capacity are described. The effect of fishway slope and fishway length on fish performance and biochemical state were measured in "endless" fishways. No evidence of fatigue was found when proper hydraulic conditions were obtained. One salmon ascended over 6,600 feet vertically. Experiments to measure swimming abilities of salmon indicated that the critical velocity was between 8 and 13 feet per second. Maximum observed swimming speed was 26.7 feet per second. Preferences of salmonids for water velocities and light conditions revealed marked differences between species. Effects of light and water velocity on rates of passage through channels and fishways are described. Experiments involving fingerling passage problems and the testing of fullscale prototype fishway designs are illustrated. Reports and publications on laboratory research are listed. (Auth. abst.)

4574. Anonymous. 1961. RESERVOIRS, A PROSPECTUS FOR SPORT FISHERY RESEARCH. U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, 30 pgs.

The purpose of this prospectus is to review some of the present circumstances about fish in reservoirs and to explore research possibilities for the future. It recognizes unequivocally the basic responsibilities of the several States to manage their waters and their fishery resources. It outlines a long-range, broad-scale and basic program of reservoir research for

the Bureau of Sport Fisheries and Wildlife recognizing that the Federal dam and reservoir construction program carries with it a Federal responsibility for such research.

4575. Huber, Earl H., and Hartford R. Kittel. 1961. A CREEL CENSUS OF A MINNESOTA NORTHERN PIKE-CENTRARCHID LAKE, LINWOOD LAKE, ANOKA COUNTY, 1951-1957. Minnesota Department of Conservation, Division of Game and Fish, Investigational Report No. 227, 11 pgs.

Quantitative creel census, covering summer angling, darkhouse spearing and winter ice angling, was conducted on Linwood Lake, Anoka County, Minnesota from December 1, 1951 to March 31, 1957. Linwood Lake was selected for this study as representative of the lake type with a northern pike-centrarchid population complex.

No significant trends were observed in fishing pressure and harvest during the six winters and five summers of this study. Fishing success seemed to be affected mostly by the relative strength of year-class of the different species being exploited by the angler.

An annual fishing pressure of about 56 man-hours per acre by summer angling, 8 man-hours per acre by winter angling and 3 man-hours per acre by darkhouse spearing harvested an annual average of about 23 pounds per acre, largely northern pike, sunfish, crappie, and largemouth bass. Harvest per acre by method included about 15 pounds by summer angling, 6 pounds by winter angling and 2 pounds by spearing. (Auth. abst.)

4576. Anonymous. 1961. POLLUTION-CAUSED FISH KILLS IN 1960. U. S. Department of Health, Education, and Welfare, Public Health Service Publication No. 847, 20 pgs.

The activity covered in this report, the first of a series to be prepared annually, has been initiated by the Public Health Service in response to the need for additional information on the effect of pollution in the Nation's waters. The Public Health Service plans to release quarterly cumulative listings of these fish kills and to publish an annual statistical summary of the results with such interpretation as may be warranted. The program went into effect June 1, 1960, and the first listing included all reports for the four-month period ending September 30. The present summary covers all the information available for the year 1960, including a few reports of fish kills which occurred before June 1.

4577. Wolf, Robert S. 1961. GRAPHIC PRESENTATION OF PACIFIC SARDINE AGE COMPOSITION DATA. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 384, 34 pgs.

Seasonal age composition summaries of the Pacific sardine in numbers of fish by year class and age are presented in graphic form by port or region of landing for the seasons of 1932-33 through 1959-60. A pictorial history of the sardine fishery for 28 years is thus presented in the bar charts, which illustrate the relative importance of certain year classes in the seasonal catch totals, and in the fluctuations of those totals over this period. (Auth. abst.)

4578. De Wit, J. J. Duyvene. 1960. HYBRIDIZATION EXPERIMENTS IN RHODEINE FISHES (CYPRINIDAE, TELEOSTEI). THE INTERSPECIFIC HYBRIDS OF RHODEUS OCELLATUS AND RHODEUS SERICEUS AMARUS AMARUS. Japanese Jour. Ichthyol. 8(1/2): 7-10; Biological Abstracts, Vol. 36, No. 13, Abst. No. 39576. 1961.

By means of hybridization experiments the presence of genetic affinity between R. sericeus amarus amarus from western Europe and R. oceilatus from Japan has been established. Both kinds of hybrids obtained from this combination were intermediate between the parental species and showed a male phenotype. In the spawning season both kinds of hybrids displayed full breeding colors and spawning behavior, but spermatogenesis was impaired. (Auth. summ.)

4579. Gromov, V. V. 1960. THE BENTHOS OF SYLVENSKII BAY IN THE PERMSKII RESERVOIR ON THE KAMA RIVER IN THE SUMMER OF 1955. (BENTOS SYLVENSKOGO ZALIVA PERMSKOGO VODOKHRANILISHCHA NA R. KAME LETOM 1955 G.) Trudy VI Soveshch. po Probl. Biol. Vnutr. Vod, 1957, M.-L., Akad. Nauk SSSR 1959: 352-357; Biological Abstracts, Vol. 36, No. 13, Abst. No. 39792. 1961.

The benthos of Sylvenskii Bay in the Permskii reservoir was studied during the second year of the existence of the reservoir in July, 1955. The upper portion of the bay retains the characteristics of a river and is generally overgrown with reeds; the lower portion of the Bay is strongly silted, but in the flooded portions there is the usual aqueous vegetation: pond weeds, yarrow, and others. The variety of the benthic fauna is decreased compared to that in the river. A total of 16 groups of invertebrates was encountered, the most common being the Tendipedidae (43 forms). The Oligochaetae populate the entire former river bed as well as, apparently, the flooded banks. The qualitative and quantitative composition of the benthos on various soils was studied. The fauna was most numerous on the flooded banks, where the average biomass of the benthos was 10.48 g/m^3 with 4330 specimens per sq. meter (accounted for mainly by the Tendipedidae). Not a single species of animal from the Sylvan fauna has yet emigrated from the river bed to the flooded dry land. Among the mollusks, the branchiata predominate in Sylva and the pulmonata in the Bay.

4580. Osipov, S. K. 1959. THE ROLE OF SUSPENDED DEBRIS IN THE PROCESSES OF FORMATION OF THE BENTHIC FAUNA IN THE RESERVOIRS OF THE DESERT. (ROL' VZVESHENNYKH NANOSOV V PROTSESSAKH FORMIROVANIIA DONNOI FAUNY VODOKHRANILISHCH PUSTYNI.) (English summary)

Zool. .Zhur. 38(9): 1303-1309; Biological Abstracts, Vol. 36, No. 13, Abst. No. 39793. 1961.

It was found that in order to create favorable conditions for the development of aquatic animals in the reservoirs of the desert, it would be suitable to construct reservoirs on the meandering curves of the river so that such reservoirs would have a longer period of life and be less affected by suspended debris. On the basis of observations in the reservoirs of the Murgab River, it was established that in order to guarantee a satisfactory quantity of edible invertebrates, the turbidity of the water in the future reservoirs along the Kara-Kumskii canal and the Murgab and Tedzhen rivers should not exceed 100-150 grams of suspended debris per m^3.

4581. Blazka, P., M. Volf, and M. Cepela. 1960. A NEW TYPE OF RESPIROMETER FOR THE DETERMINATION OF THE METABOLISM OF FISH IN AN ACTIVE STATE. (Russian summ.) Physiol. Bohemoslov. 9(6): 553-558; Biological Abstracts, Vol. 36, No. 13, Abst. No. 40059. 1961.

A flow type of respirometer is described for the determination of O_2 utilization of swimming fish at various speeds of swimming. The instrument was constructed in two models, a laboratory model for work with trout weighing 100-120 g, and a field model for work with migrating salmonids weighing 4-5 kg. Flow parameters were measured in the laboratory type. Calculations are shown for cases of attained steady state and for cases where the concentration of tested substances in the inner cylinder changes from one steady state to a new steady state. (P. H.)

4582. Butskaia, N. A. 1959. THE FOLLICULAR EPITHELIUM OF THE TESTES AND ITS FUNCTIONAL CHARACTERISTICS RELATED TO THE TYPE OF SPAWNING (WITH THE EXAMPLE OF THE PERCH). (FOLLIKULIARNYI EPITELII SEMENNIKOV I OSOBENNOSTI EGO FUNKSTII, SVIAZANNYE S TIPOM NERESTA (NA PRIMERE OKUNEVYKH). (English summ.) Zool. Zhur. 38 (12): 1844-1849; Biological Abstracts, Vol. 36, No. 13, Abst. No. 40547. 1961.

The author analyzes the changes taking place in the follicular epithelium of the testes during the transition of fish to the spawning state, and explains the functional peculiarities of this epithelium in the perch and pike, in which there is simultaneous ovulation in the females and brief spawning in the males, and in the ruff, in which ovulation in the females occurs in groups and there is prolonged (1 1/2-2 months) spawning in the males. In the pre-spawning period, the structure of the follicular epithelium is similar in the 2 spp studied, but during the spawning period it differs. As a result of histological analyses, it was established that the brevity of spawning in the perch and pike and its prolongation in the ruff depend, not on differences in the type of formation of the sexual cells, but on differences in the process of excretion of the mature sexual products during the spawning period. In the perch, a rapid excretion of the follicular epithelium of the seminiferous tubules, so that rapid dilution of the mass of spermatozoa takes place. In the pike, the rapid and intensive dilution of the spermatic mass is brought about by the exudative processes in the testes. In the ruff, this process of dilution of the mass of sexual cells in the seminiferous tubules is lacking, and the formation of seminal fluid only takes place in the sperm duct.

4583. Yariv, J., and S. Hestrin. 1961. TOXICITY OF THE EXTRACELLULAR PHASE OF PRYMNESIUM PARVUM CULTURES. Jour. Gen. Microbiol. 24(2): 165-175; Biological Abstracts, Vol. 36, No. 13, Abst. No. 41023. 1961.

Cytotoxic material ("prymnesin") excreted into the growth medium by the phytoplagellate Prymnesium parvum was partially purified and crudely characterized. It proved to be a highly potent haemolysin; its solubility properties and some other characteristics are those of a lipid, perhaps a saponin. The high haemolytic activity which characterized the toxin was often also accompanied by a high ichthyotoxic activity. A method of locating haemolytic activity in a paper chromatogram is described. Fish were killed not by prymnesin alone, but were rendered highly susceptible to prymnesin poisoning by a range of cofactors: streptomycin sulphate, calcium chloride, magnesium chloride. Ichthyotoxicity in cofactor + prymnesin systems conformed within a wide concentration range to the relationship: $a \times b = Q$, where a is a prymnesin concentration, b a minimum concentration of cofactor which elicits a lethal effect in presence of a, and Q is a cofactor-specific constant. The recognition of this relationship has enabled a sensitive assay to be developed. Practical implications are discussed and the hypothesis proposed that prymnesin acts on fish by inducing a state of abnormal permeability of the gill. (Auth. abst.)

4584. Kryzhanovskii, S. G. 1960. SIGNIFICANCE OF THE FATTY INCLUSION BODIES IN FISH EGGS. (O ZNACHENII ZHIROVYKH CKLIUCHENII V IAITSAKH RYB.) (English summ.) Zool. Zhur. 39 (1): 111-123; Biological Abstracts, Vol. 36, No. 13, Abst. No. 41218. 1961.

The number, shape, position, size and composition of the fatty inclusion bodies in the roe differ in various species of fish. Representatives of fresh-water and salt-water fish were examined. The amount of fat varied from 0.085 to 22.34% (of the dry weight). The largest percentage of fat was found in the eggs of the elasmobranchs, followed by the ganoids and Salmonidae, and finally by the remaining teleosts. The differences in the amount of fatty deposits in the roe of various species of fish reflect the nature of their adaptation to the nutritive conditions during the initial stage of the larval period of development. Fat in the form of droplets fulfills a hydrostatic role. The position of the fat droplet in the yolk sac determines the direction in which the newborn will swim after emerging from the membrane. In the embryos of fresh-water fish (whitefish, perch, eels), the fat droplet is situated under the front part of the head (except in the American perch), while in the embryos of the

majority of pelagophilic salt-water fish, it is situated in the posterior portion of the yolk sac.

4585. Bagenal, T. B. 1961. THE LONG ROUGH DABS OF THE CLYDE SEA AREA. Jour. Marine Biol. Assoc. United Kingdom 41(1): 49-57; Biological Abstracts, Vol. 36, No. 13, Abst. No. 42920. 1961.

The biometry of the Clyde population of long rough dabs Hippoglossoides platessoides limandoides has been compared with the descriptions of the European and American races. Of the various body measurements and meristic characters considered the numbers of scales in the lateral line, and between the lateral line and the middle of the back are the most diagnostic racial character. The fin ray counts fit into a pattern of increasing number with higher latitude when compared with other published data. There is a correlation between the number of anal and dorsal fin rays and between these and the number of vertebrae. The variations that were found in the vertebrae of 51 fish are described in detail. Only one sinistral long rough dab has been found out of 2357 specimens examined. From the British fishing statistics it is shown that the long rough dab is of little, and declining, commercial importance. In Canada, however, the American ssp. is becoming more important commercially. (Auth. abst.)

4586. Labrique, J.-P. 1961. DIRECT CURRENT MEASUREMENT OF THE ELECTRICAL CONDUCTIVITY OF WATERS. (LA MESURE EN COURANT CONTINU DE LA CONDUCTIVITE ELECTRIQUE DES EAUX.) Vegetatio 10(1): 42-52; Biological Abstracts, Vol. 36, No. 14, Abst. No. 43084. 1961.

At low conductivities errors using DC are lessened. Two portable instruments using a DC source and successfully employed for ecological purposes are described, with wiring charts, and illustrated. (1) A direct-reading conductivity bridge covering in 8 steps the scale from 0 to 25 micromhos/cm to 0 to 5 millimhos/cm, with an absolute precision of 3%. (2) A compensation conductivity bridge which, for conductivities less than 500 micromhos/cm, gives a reproducibility of 0.1% with an absolute precision of 28%. (J. M.)

4587. Clyma, Wayne, and W. L. Broadhurst. 1961. CLARIFICATION OF PLAYA LAKE WATER BY AERIAL APPLICATION OF A FLOCCULATING AGENT. Texas Agric. Exptl. Sta. Progr. Rept. 2168. 1-6; Biological Abstracts, Vol. 36, No. 14, Abst. No. 43513. 1961.

Dusting playa lakes with a nontoxic, synthetic, organic flocculent removed 43 to 93% of the silt and clay in the water. The flocculent was applied to the lake surface with a crop-dusting plane. Wave action, caused by wind, mixed the flocculent with the lake water sufficient to produce flocculation, and settlement of the sediments resulted. (Auth. abst.)

4588. Huet, M., and J. A. Timmermans. 1960. FISH POPULATION OF A BREEDING PLACE ALONG THE MEUSE RIVER IN BELGIUM. (POPULATION PISCICOLE D'UNE FRAYERE EN BORDURE DE LA MEUSE BELGE.) Schweiz. Zeitschr. Hydrol. 22(1): 451-460; Biological Abstracts, Vol. 36, No. 14, Abst. No. 43515. 1961.

A marsh meadow along the Meuse River is flooded every spring, and remains in permanent connection with the river by conduits. The marsh meadow is used as a breeding place by fishes from the Meuse. A check was made of the population of juveniles. The population was very similar to that of the river except that the species that are most distinctly rheophilous were rare or absent (e. g., trout). The population was principally formed of small fish (5-15 cm), but it was very large, amounting to about 820 kg/ha. (C. C. D.)

4589. Vivier, P. 1960. TEMPERATURE AND DISSOLVED OXYGEN IN DEEP WATER IN FRENCH ARTIFICIAL RESERVOIRS. (TEMPERATURE ET OXYGENE DISSOUS EN PROFONDEUR DANS LES LACS DE BARRAGE ARTIFICIEL FRANCAIS. Schweiz. Zeitschr. Hydrol. 22(1): 350-364; Biological Abstracts, Vol. 36, No. 14, Abst. No. 43531. 1961.

The temperature regime of artificial lakes differs from that of natural lakes because of the removal of water for hydroelectric power. In deep artificial lakes where the sluices are in the lower part of the dam, marked temperature stratification does not occur, and the deeper waters have a considerably higher temperature in summer than occurs in comparable natural lakes. If the sluices are in the upper portion of the dam, stratification becomes more marked and the deeper water remains colder. Likewise, if the sluices are near the bottom of the dam, the oxygen content of the water is favored, especially if the reservoir is deep. If the removal of water is in the upper half of the dam the oxygen gradient is enhanced and the deep waters are more or less deprived of oxygen. (C. C. D.)

4590. Small, Lawrence F. 1961. AN OPTICAL DENSITY METHOD OF MEASURING PHYTOPLANKTON STANDING CROP. Iowa State Jour. Sci. 35(3): 343-353; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47009. 1961.

Estimation of phytoplankton standing crop involves collection of adequately representative samples and determination of the phytoplankton per sample. For each estimate, one liter of lake water was centrifuged in a continuous-flow centrifuge at the rate of one liter per eight minutes, the concentrate was made up to 30 milliliters with 90% reagent-grade acetone, and the extraction was allowed to take place for one-half hour at a constant temperature of 120°F. Longer extraction is more complete, but deterioration of chlorophyll may be greater than the increased extraction. Use of two liters per sample did not give better results than one liter samples. When the extraction phase was completed, the green supernate was read in a Bausch and Lomb "Spectronic 20" spectrophotometer at a 665 mμ wave length to obtain the optical

density of chlorophyll "a". The optical densities can then be converted to "units of count" providing the species composition remains fairly constant. (Auth. abst.)

4591. Ivlev, Victor S. 1960. THE DISTRIBUTION OF YOUNG FISH IN A GRADIENT OF LIGHT. (DIE VERTEILUNG DER JUNGFISCHE BEI GRADIENT-BELEUCHTUNG.) Internatl. Rev. Ges. Hydrobiol. 45(4); 567-579; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47321. 1961.

Young fish were subjected to a gradient of light in an apparatus that is described. The gradient ranged from 0 to 800 Lux. The fish then were stunned electrically and counted in their positions in the gradient. Young of Anguilla anguilla, Carassius carassius, Pungitius pungitius and Salmo salar were distinctly photophobic. Those of Salmo trutta fario, Coregonus autumnalis migratorius and Cyprinus carpio were distinctly photophilic. Young Salmo irideus were intermediate in their response. Age differences had little effect on the responses of Salmo salar and Anguilla anguilla, but completely reversed the response of Coregonus autumnalis migratorius. Older Cyprinus carpio were less photophilic than younger specimens. A distinct effect of adaptation is shown for Salmo salar and Cyprinus carpio. Differences are exhibited also in response to different temperatures and to pH. (C. C. D.)

4592. Waterman, Talbot H. 1959. ANIMAL NAVIGATION IN THE SEA. Gunma Jour. Med. Sci. 8(3): 243-262; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47340. 1961.

In illustrating the general thesis that aquatic animals must solve their underwater navigation problems by mechanisms essentially analogous to those used in sailing a submarine we have ranged widely through the results of recent research. In the case of the ultrasonic and electrical devices for animal orientation both the transmission and detection of signals was involved; in the optical case only the detector would be concerned since the signal is of natural origin. In all three cases the effective use of the navigational device is correlated with locomotor activity and complex behavior which make it possible for the animals to take advantage of the information supplied. In the optical case of polarized light orientation crucial experiments on mechanism and field significance are still in the future; for the other two, whose basic properties are much clearer, there still remain a number of challenging unsolved problems. (Auth. abst.)

4593. Ridgway, G. J., J. E. Cushing, and G. L. Durall. 1961. SEROLOGICAL DIFFERENTIATION OF POPULATIONS OF SOCKEYE SALMON, ONCORHYNCHUS NERKA. Bull. Internatl. North Pacific Fish Comm. 3. 5-10; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47370. 1961.

As part of a study applying serological methods to the distinction of salmon races, the normal serums of human beings, cattle, horses, sheep, pigs, goats, brown bullheads, and other salmon were tested for agglutinative activity with the erythrocytes of sockeye salmon. Only horse serum and pig serum reacted strongly with the salmon cells. With some of the pig serums tested, consistent differences were found in the strength of reaction of the cells of individual sockeye salmon. The frequencies of individuals displaying the various strengths of reaction were found to differ significantly between areas of origin of the salmon tested. When techniques of population genetics were used, evidence for the possible genetic control of the observed differences was obtained. (Auth. abst.)

4594. Smirnov, A. I. 1959. FUNCTIONAL SIGNIFICANCE OF THE PRESPAWNING CHANGES IN THE INTEGUMENT OF THE SALMON (FOR EXAMPLE THE GENUS ONCORHYNCUS). (FUNKTSIONAL'NOE ZNACHENIE PREDNERESTOVYKH IZMENENLI PIKROVOV LOSOSEI (NA PRIMERE RODA ONCORHYNCHUS).) Zool. Zhur. 38(5): 734-744; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47372. 1961.

The changes in the integument and the appearance of the bright spawning coloration of the salmon are looked upon as an adaptive response to a change in the environment.

4595. Fabian, Michael W. 1960. MORTALITY OF FRESHWATER AND TROPICAL FISH FRY BY CYCLOPOID COPEPODS. Ohio Jour. Sci. 60(5): 268-270; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47411. 1961.

Mortality of larval fish increased at the concentrations of Cyclops vernalis and C. biscuspidatus. With 200 or more Cyclops per liter, mortality of a test group was 46.4%, and there were no deaths in the control group, after one day. (Auth. abst.)

4596. Faktorovich, K. A. 1959. APPEARANCE OF LIPOID DEGENERATION OF THE LIVER IN SALMO IRIDEUS IN CONNECTION WITH THE USE OF ARTIFICIAL FOOD. (O IAVLENII LIPOIDNOI DEGENERATSII PECHENI RADUZHNOI FORELI V SVIAZA S PRIMENENIEM ISKUSSTVENNYKH KORMOV.) Trudy Soveshchanii Ikhtiol. Komiss. Akad. Nauk SSSR 9. 69-73; Biological Abstracts, Vol. 36, No. 16, Abst. No. 47412. 1961.

In 1956, an investigation of 5 trout-rearing farms in the USSR was carried out. In 3 of these the trout were found to have lipoid degeneration of the liver. The basic symptom was the deposition in the liver of a sudanophilic substance which was insoluble in organic solvents. The deposits were sometimes so large that they completely destroyed the liver parenchyma. The liver lesion was often accompanied by intestinal inflammation. Kidneys were not affected. The sick trout, unlike the healthy ones, were sluggish, had no appetite, and had a darker coloration. The disease was observed in rearing farms where trout were fed on stale fish, stored for a long time in air, flour of silk-worm pupae, and fish-and-bone meal. There was no such disease among trout fed on fresh fish and fish wastes.

4597. Kosheva, A. F. 1959. EFFECT OF THE

REGULATION OF THE FLOW OF THE VOLGA RIVER ON FISH PARASITES. (VLIIANIE ZAREGULIROVANIIA STOKA REKI VOLGI NA PARAZITOFAUNU RYB.) Trudy Soveshchanii Ikhtiol. Komis. Akad. Nauk SSSR 9. 120-122; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47419. 1961.

The morbidity among fish in the reservoir is lower than among similar fish in the Volga. Under reservoir conditions, infection of the fish by Protozoa, digenetic trematodes, nematodes and acanthocephelans is decreased, while on the other hand, infection by monogenetic trematodes, leeches and Crustacea is somewhat increased.

4598. Lebedeva, L. I. 1959. THE EFFECT OF REARING CONDITIONS ON THE BLOOD PICTURE IN YOUNG SALMO IRIDEUS. (VLIIANIE USLOVII VYRASHCHIVANIIA NA POKAZATELI KROVI MOLODI RADUZHNOI FORELI.) Trudy Soveschanii Ikhtiol Komis. Akad. Nauk SSSR 9: 78-80; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47421. 1961.

Young trout were reared (I) on natural food in ponds with a stocking density of 5 per m^2, and (II) in cement pools, on artificial food, with a density of 500 per m^2. The growth of group II lagged behind group I. The body fat content of II was considerably higher than I. In I, the Hb content reached 57%, the number of erythrocytes was 1.58 million/mm^3, and the immature cells 7.4%. In II, the Hb content fell below 10-20% the number of erythrocytes was 0.065 million/mm^3, and the immature cells were 47%.

4599. Moiseev, P. A. 1960. THE BEHAVIOR OF THE PACIFIC CODFISH IN VARIOUS ZOOGEOGRAPHIC REGIONS. (O POVEDENII TIKHOOKEANSKOI TRESKI V RAZLICHNYKH ZOOGEOGRAPHIC REGIONS.) (English summ.) Zool. Zhur. 39(4): 558-562; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47424. 1961.

The Pacific codfish occurs along the Pacific coast from Bering Strait to the Yellow Sea, and thus penetrates into regions whose oceanological regime is substantially different from the typical environment of cod in arctic regions. In the arctic regions of the Bering Sea and the Coast of west Kamchatka, cod migrates in spring from deep to shallow water where food is plentiful; in autumn and winter it migrates to great depths (200-300 m). In subarctic regions (S. E. coast of Korea and E. coast of Hokkaido) the migration pattern, the regions of spawning and the seasonal distribution of codfish are reversed: since the water warms up to 20° in summer, the cod migrate from the coast to deep water in spring, down to 200-400 m. In autumn, when the littoral waters begin to cool off, the migration is into the coastal waters, where spawning occurs.

4600. Tsvetkov, L. 1957. THE MICROBENTHOS OF THE BULGARIAN COASTAL LAKES AND THE SIGNIFICANCE OF THE MICROBENTHOS FOR THE FISH PRODUCTIVITY OF BODIES OF WATER. (O MIKROBENTOSE BOLGARSKIKH PRIBREZHNYKH OZER I ZNACHENII MIKROBENTOSA DLIA RYBOPRODUKTIVNOSTI VODOEMOV.) Trudy VI Soveshch. po Probl. Biol. Vnutr. Vod, 1957; Biological Abstracts, Vol. 36, No. 15, Abst. No. 47435. 1961.

The number of Ostracoda in certain lakes is very high (up to 48 g/m^2). The characteristic species for all the lakes studied is Cyprideis littoralis. The composition of the pelophilic Crustacea, (which properly speaking, are micronectobenthos) includes certain species of Cladocera and Copepoda. The biomass of the micronectobenthos is relatively small, but in certain cases it is sharply increased and even exceeds the biomass of the Chironomidae. The quantitative dynamics of the microbenthos were also studied. The components of the micronectobenthos are good foodstuff for fish, and in its productive qualities the micronectobenthos represents an essential factor in fish productivity.

4601. Vladykov, Vadim D. 1961. PRELIMINARY LIST OF MARINE FISHES OF QUEBEC. Nat. Canadien 88(3): 53-78; Biological Abstracts, Vol. 36, No. 15, Abst. No. 50677. 1961.

List covers the area from the Labrador and New Brunswick coasts to Quebec City. Fifty-one families and 123 spp. are briefly treated. Included are new records of Carcharodon carcharias (Isuridae), and Poronotus triacanthus (Stromateidae). There is a bibliography of 70 titles. (G. R. B.)

4602. Hastings, Ellsworth, Walter H. Kittams, and J. H. Pepper. 1961. REPOPULATION BY AQUATIC INSECTS IN STREAMS SPRAYED WITH DDT. Ann. Ent. Soc. Amer. 54(3): 436-437; Biological Abstracts, Vol. 36, No. 16, Abst. No. 51156. 1961.

Population changes in Ephemerida, Trichoptera, and Plecoptera in two high-gradient mountain streams were studied over a 4-year period, following a large scale spray operation. A drastic and widespread reduction in all forms took place immediately after spraying. Trichopterans in cases of the type constructed by the family Leptoceridae were extremely numerous before spraying. No live specimens of this form were obtained during the succeeding 4-year period. Over this period, increase in number of Ephemerida in one stream was linear. Analysis of variance tests showed that, in every other instance no numerical relationship existed in the repopulation of ephemerids or trichopterans. Population numbers of these two forms did not level off until 3 years after spray application. Populations of plecopterans leveled off the year following the spraying. (Auth. abst.)

4603. Klimek, L. 1960. STUDIES UPON BOTTOM FAUNA OF THE LAKE DRUZNO. (In Polish with English summ.) Zeszyty Nauk. UMK, Torun, Poland. Biol. 5. 29-69; Biological Abstracts, Vol. 36, No. 16. Abst. No. 51176. 1961.

Bottom catches were performed with an Ekman-Birge sampler, and species or groups of species determined. A correlation between the concentration of calcium and the abundance of Elodea canadensis and

Molluska was found. Similar correlation exists between the amount of detritus and the development of Oligochaeta and Tendipedidae. The lake determined belongs to the pond type and cannot be included in classifications of Thienemann, or Lundbeck. It is almost entirely covered by the vegetation; depth is 1 m. The biomass of the benthos is very large, amounting to 1264 kg/ha. Most numerous are mollusks, among them, Dreissena polymorpha about 1223 kg/ha, with smaller quantities of Tendipedidae, Oligochaeta, Crustacea, etc. The productivity calculated according to Blegvads formula, is 105 kg/ha, but actual fish productivity is very low (30 kg/ha). The author is inclined to see in it a consequence of large quantities of waterfowl on the lake which is an important game reserve. The water birds are carriers of various fish parasites, which limit the present number of fish in the lake. (H. Z.)

4604. Barrington, E. J. W. 1961. METAMORPHIC PROCESSES IN FISHES AND LAMPREYS. Amer. Zool. 1(1): 97-106; Biological Abstracts, Vol. 36, No. 16, Abst. No. 53104. 1961.

The metamorphosis of salmonid fish is discussed from the standpoint both of function and of structure. The thyroid gland seems to play an important part, smolt- transformation making an increased demand for thyroid hormones. Problems relating to the functions of the thyroid gland in fish are discussed, and it is suggested that metamorphosis in salmonids depends in part upon the utilization of normal thyroid functions to meet the special needs of the metamorphic crisis. Reference is made also to other examples of metamorphosis in fish where the same principle may well apply. In the cyclostomes the endocrine system is probably similarly involved in metamorphosis, but with considerable differences in detail resulting from the evolutionary status and morphological organization of these animals. (Auth. abst.)

4605. Bernstein, Jerald J. 1961. LOSS OF HUE DISCRIMINATION IN FOREBRAIN-ABLATED FISH. Exptl. Neurol. 3(1): 1-17; Biological Abstracts, Vol. 36, No. 17, Abst. No. 54902. 1961.

The effect of forebrain ablation on hue discrimination in fish has been studied. Cardiac deceleration, a conditioned autonomic response, was used as measure of discrimination in a series of goldfish. Electric shock was the unconditioned stimulus. Forebrain-ablated fish were trained to a red and a green stimulus selected to be of equal brightness. These fish were subsequently tested on red and green stimuli of known brightness as perceived by these experimental animals. Normal fish in this situation reacted to the test stimuli on the basis of their wave-length characteristics, but forebrainless animals reacted only to the brightness and not to the wavelength characteristics of the test stimuli. Other control tests substantiate this finding. (Auth. abst.)

4606. Bernstein, Jerald J. 1961. BRIGHTNESS DISCRIMINATION FOLLOWING FOREBRAIN ABLATION IN FISH. Exptl. Neurol. 3(3): 297-306; Biological Abstracts, Vol. 36, No. 17, Abst. No. 54903. 1961.

The effect of forebrain ablation on brightness discrimination in goldfish has been studied. Cardiac deceleration, a conditioned autonomic response, was used as the measure of discrimination in a series of goldfish. Normal and forebrain-ablated fish were trained to discriminate between two gray stimuli of different brightness. If the experimental animal made this brightness discrimination in thirty-five trials it was subsequently tested on a black and white stimulus pair to see whether the fish was capable of stimulus generalization. If the fish did not make the brightness discrimination, it was trained to discriminate a different set of stimuli to show that it was conditionable. It was found that forebrain ablation did not result in any loss in the ability of these operated fish to make a brightness discrimination. In fact, the operated animals learned the brightness discrimination more rapidly than normal animals. Furthermore, the forebrainless fish were able to generalize to another brightness problem. Control tests were run to substantiate this finding. (Auth. abst.)

4607. Nomura, H. 1960. CONSIDERATIONS ON THE SAMPLING OF MARINE FISHES. (CONSIDERACOES SOBRE AMOSTRAGEM DE PEIXES MARINHOS.) (English summ.) Bol. Inst. Oceanogr. 11(1): 99-119; Biological Abstracts, Vol. 36, No. 17, Abst. No. 55001. 1961.

In this paper the author defines some statistical terms used, describes the sampling techniques adopted in the study of some fish, and quotes some problems concerning the determination of the composition of the stocks. The commercial fleet was utilized to sample the stocks of fish, in the assumption that the catch as landed on the fish market reflects the composition of the stocks in the sea. The paper is restricted to the evaluation of the length distribution of sardine landed and for that purpose the author examined 143 samples taken at random from August 1958 to December 1959. The analysis of those samples are shown in Table II and were plotted in Figure 3. The reliable sample size limit for sardine was established as 300, with the acceptance of an error of 0.1 cm, considering the catch per boat as a population. (Auth. abst.)

4608. Ivanova, M. N. 1959. NUTRITION OF PIKE IN THE RYBINSKII RESERVOIR. (O PITANII SHCHUKI RYBINSKOGO VODOKHRANILISHCHA.) Trudy VI Soveshch. Probl. Biol. Vnutr. Vod, 1957. M.-L., Akad. Nauk SSSR: 311-316; Biological Abstracts, Vol. 36, No. 17, Abst. No. 54996. 1961.

The principal food (70%) of adult pike is fish of little value (roach, perch and ruff, primarily young fish 20-70 mm in length.) Pike more than 700 mm long begin to feed on larger fish (100-600 mm). Intensive feeding coincides with the approach of the food fish to the banks of the reservoir. The pike can be considered to have a useful role in the fishing industry of the reservoir.

4609. Tesh, F. V. 1959. HIGH NUTRITIVE CAPACITY AND FISH PRODUCTIVITY IN THE RESERVOIRS USED FOR REARING CYPRINID FISHES. (O VYSOKOI KORMNOSTI I RYBPRODUKTIVNOSTI VODOKHRANILISHCH ISPOL' ZUEMYKH DLIA RAZVEDENIIA KARPOVYKH RYB.) Trudy VI Soveshch. Probl. Biol. Vnutr. Vod. 1957. M-L. Akad Nauk. SSSR, 1959: 605-609; Biological Abstracts, Vol. 36, No. 17, Abst. No. 55504. 1961.

In running-water-ponds of the Kribstein channel type which are poor in biogenic elements (especially Ca), the density of the benthos is 5607 individuals per m^2, including 4550 Tubificidae. The yield of fish reaches 92 kg/hectare, and can be increased. The high nutritive capacity of the pond is explained by the intensive incoming alluvium which forms a layer of productive silt on the bottom. Observations on other reservoirs have also shown that their productivity decreases if the alluvium settles in running-water lakes situated higher up on the stream.

4610. Dorris, Troy C., and John L. Butler. 1961. AN EASILY-ASSEMBLED WATER SAMPLER. Turtox News 39(4): 108-109; Biological Abstracts, Vol. 36, No. 18, 1961.

Simple apparatus made from standard lab. clamps and polyethylene bottles and tubing for collecting water samples for chemical analysis is described. (R. W. D.)

4611. Hall, T. F. 1961. PRINCIPLES OF AQUATIC PLANT CONTROL. Advances in Pest Control Res. 4: 211-247; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59024. 1961.

Recent developments are reviewed. There are 19 references.

4612. Hubschman, Jerry H. 1960. RELATIVE DAILY ABUNDANCE OF PLANKTONIC CRUSTACEA IN THE ISLAND REGION OF WESTERN LAKE ERIE. Ohio Jour. Sci. 60(6): 335-340; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59026. 1961.

Data presented show great variation in the planktonic crustacea population when sampled daily at the same location with the Juday Plankton Trap. During the summer there was a progressive shift in the copepod population from predominantly carnivorous (Cyclopoida) to one of largely herbivorous (Calanoida) components. Both copepod and cladoceran populations exhibited blooms in early July followed by low densities in late July. Cladocera (other than Leptodora) showed the most daily variation in numbers during the period studied. Quantitative data presented indicate the possible errors inherent in taking plankton samples at weekly intervals. Leptodora kindtii was found to occur in very low densities in the open water of the Bass Island Region of Lake Erie. (Auth. abst.)

4613. Sechriest, Ralph E. 1960. RELATIONSHIP BETWEEN TOTAL ALKALINITY, CONDUCTIVITY, ORIGINAL pH, AND BUFFER ACTION OF NATURAL WATER. Ohio Jour. Sci. 60(5): 303-308; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59036. 1961.

In order to determine the carbon supply available to various aquatic organisms, conductivity, total alkalinity, original pH, and buffer action of natural water samples were measured. Analysis of the data showed a low, positive correlation (r_s = 0.3) between the original pH of the sample and total alkalinity, slope of the buffer curve, and conductivity. A higher positive correlation (r = 0.7) was found between total alkalinity and the slope of the buffer curve and conductivity. The range of least buffering action occurred between the pH range of 8.2 to 8.6. The low correlations indicate that other chemical and physical properties must affect buffer curves in natural waters. (R. E. S.)

4614. Woodson, Bernard, and G. W. Prescott. 1961. ALGAE OF THE JAMES RIVER BASIN, VIRGINIA. I. ZYGNEMATACEAE AND OEDOGONIACEAE. Trans. Amer. Microsc. Soc. 80(2): 166-175; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59041. 1961.

This report is the first of several which we propose to make from studies of the algal flora of Virginia. The initial study, made in 1956, was a survey of the Chlorophyta of the James River Basin. Field work included the taking of limnological and ecological data, as well as year-round qualitative sampling of the algae at nearly 100 selected stations. Ecological and descriptive data are included to acquaint the reader with the general topography of the area covered in the investigation, as well as some idea of the nature of the soils drained by the James River. A plate illustrating the identifiable species of the Zygnemataceae and Oedogoniaceae which are new records for Virginia is included. Brief descriptions of the habitat and species identified are also included, and a brief discussion of ecological factors that may have determined the number and kinds of species observed in this survey is presented. (B. W.)

4615. Zerov, K. K. 1960. BASIC FEATURES OF THE FORMATION OF VEGETATION IN THE KAKHOVKA RESERVOIR IN THE THREE YEARS OF ITS EXISTENCE. (OSNOVNI OSOBLYVOSTI FORMUVANNIA ROSLYNNOSTI KAKHOVS'KOHO VODOIMYSHCHA ZA TRY ROKY IOHO ISNUVANNIA. (Russian and English summ.) Ukrain. Bot. Zhur. 17(1): 3-11; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59042. 1961.

The Kakhovka Reservoir was established in 1955. Its area is 2300 km, length 247 km. Formation of vegetation in the reservoir is related to its morphology, its level, and the composition of the vegetation formerly existing in the floodlands of the Dnepr. It proceeds at the expense of distribution of the previous brushwood and colonization by water plants of the shoal water sections. Of previous water plants noticed at great depths (5-6 m) the most stable are Polygonum amphibium and Phragmites communis. The population of new shoal-waters began with the first months of existence of the Reservoir and at the end of the 3d year

of water vegetation it is found in the first stages of formation. The most quickly overgrown was the upper part of the Reservoir in the territory of the Konskii plains.

4616. Khrapkova, N. V. 1959. SPAWNING ASSEMBLAGES OF FOOD FISHES IN THE KRONOTSK GULF. (NERESTOVYE SKOPLENIYA PROMYSLOVYKH RYB V KRONOTSKOM ZALIVE. Trudy Inst. Okeanol. Akad. Nauk SSSR 36: 123-142; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59056. 1961.

Characteristics of spawning and spawning areas in the Kronotsk Gulf are given for 7 species of fish: Theragra chalcogramma, cod and 5 species of flounder. The spawning of Theragra begins in March and lasts till May. By the end of the spawning period the spawning school migrates from the western part of the Gulf to shallow waters. Pleuronectes quadrituberculata begins to spawn in April and ends in May. May is the spawning time of Platichthys stellatus and Hippoglossoides elassodon. Before spawning their agglomerations are located about the mouth of the underwater valleys.

4617. Legeza, M. I. 1959. SOME DATA ON THE DISTRIBUTION OF FLOUNDERS IN THE REGION OF THE NORTHERN KURIL ISLANDS. (NEKOTORYE DANNYE O RASPREDELENII KAMBALOVYKH RYB V RAIONE SEVERNYKH KURIL'SKIKH OSTROVOV. Trudy Inst. Okeanol. Akad. Nauk SSSR 36: 275-281; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59057. 1961.

Systematic catches by means of otter trawls, a beam trawl and the Seagsby trawl showed that the densest concentrations of flounders in April and May are found between Shumshu Island and the southeast coast of Kamchatka. In July and August the best catches were obtained to the east of Shumshu Island. The most numerous types were Lepidopsetta bilineata, Limanda aspera and Hippoglossoides elassodon. The largest (over 60 cm) were the halibut (Hippoglossus hippoglossus) and Cleisthenes herzensteini. Successful commercial trawling is possible at depths of 35-100 meters, in the zone where flat Echinoidea and large bivalve mullusks predominate. These invertebrates are encountered in the stomachs of flounders.

4618. Liu, Cheng-Tsung. 1960. THE ZOOBENTHOS AND THE DIET OF BENTHOPHAGOUS FISHES OF LAKE DALAI-NOR (CHINESE PEOPLE'S REPUBLIC). (ZOOBENTOS I PITANIE BENTOSOYADNYKH RYB OZER A DALAINOR (PITAISKAYA NARODNAYA RESPUBLIKA.) Zool. Zhur. 39(2): 263-277; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59059. 1961.

The benthos of Lake Dalai-nor, tributary to the Amur River, is basically composed of larvae of Chironomidae; oligochaetes are of some importance and mollusk are practically absent. The biomass of the benthos is not large. The predominance of living larvae of Procladius in the benthos lowers the productivity of the basin. The food of carp and crucian carp, the most numerous fish in the lake, is very similar; plant food predominates. Carp yearlings feed chiefly on Copepoda, Coleoptera, and larvae of Chironomidae. At age 2+ plants and Chironomidae larvae are found in carp digestive tracts in almost equal amounts. Beginning at age 3+ plant food predominates. The crucian carp feed mainly on plant food and zooplankton.

4619. Mukhacheva, V. A. 1959. CONGREGATION FOR SPAWNING OF COMMERCIAL FISH IN THE REGION OF THE NORTHERN KURILE ISLANDS AND SOUTHERN KAMCHATKA. (NERESTOVYE SKOPLENIYA PROMYSLOVYKH RYB V RAIONE SEVERNYKH KURIL'SKIKH OSTROVOV I YUZHNOI KAMCHATKI.) Trudy Inst. Okeanol. Akad. Nauk SSSR 36: 259-274; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59062. 1961.

Spawning of the walleye pollack (Theragra chalcogramma) takes place in April and May at depths of from several dozen to 500 m, usually at a definite bottom temperature. The number of eggs recovered under 1 m^2 of ocean surface exceeded 15,000,000 in some cases. Less intensive spawning also continues in June-July. The eggs, pre-larvae, and larvae of the pollack are carried by the current from the Kamchatka spawning grounds into the open sea. The flatfish Pleuronectes quadrituberculata spawns in April off the western coast of Kamchatka; in May, it also spawns off the eastern coast, and off the southern Kurile Islands. The depth at which spawning takes place varies from 47 to 585 m, the bottom temperature from -0.28 to +2.05°C. The number of eggs recovered under 1 m^2 ocean surface in May exceeded 500. The long rough dab (Hippoglossoides platessoides) spawns in May, chiefly at a depth of 50-570 m. Data were also obtained on the spawning of Hippoglossoides elassodon, the starry flounder (Platichthys stellatus), the cod, and the rock sole (Lepidopsetta bilineata).

4620. Rass, T. S. 1960. COMMERCIAL-GEOGRAPHIC COMPLEXES OF THE ATLANTIC AND PACIFIC OCEANS AND THEIR COMPARISON. (PROMYSLOGO-GEOGRAFICHESKIC KOMPLEKEY ATLANTICHESKOGO I TIKHOGO OKEANOV I IKH SOPOSTAVLENIE.) Trudy Inst. Okeanol. Akad. Nauk SSSR 31: 3-18; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59066. 1961.

Approximately 70% of the world take of fish and invertebrates is procured in the temperate and cold waters of the northern hemisphere. This take is composed of 3 assemblages of commercial species--the arctic, northern-boreal, and southern-boreal. There are separate complexes in tropical and antiboreal (Australian) waters. In the Pacific Ocean, the southern-boreal and tropical complexes are responsible for the largest takes (sardine, saury, mackerel, tuna, etc.); in the Atlantic, the northern-boreal complex (herring, cod, etc.) supply the largest catches. Comparison of the Pacific and Atlantic Ocean complexes leads one to think of the possibility of introducing a number of Pacific species in the Atlantic--greenling, several flatfishes, saury, and Corvina

nigra.

4621. Steffens, W. 1961. FIN DAMAGE IN THE PIKE (ESOX LUCIUS). (FLOSSENSCHADIGUNEN BEIM HECHT.) Biol. Zentralbl. 80(1): 79-84; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59068. 1961.

A specimen deficient in fin structure serves as a basis for a general discussion of the influences which may produce such anomalies. (D. S. G.)

4622. Robertson, O. H., et al. 1961. PHYSIOLOGICAL CHANGES OCCURRING IN THE BLOOD OF THE PACIFIC SALMON (ONCORHYNCHUS TSHAWYTSCHA) ACCOMPANYING SEXUAL MATURATION AND SPAWNING. Endocrinology 68(5): 733-746; Biological Abstracts, Vol. 36, No. 18, Abst. No. 59883. 1961.

A study was made of the changes occurring in a number of blood constituents during the spawning migration of the Pacific salmon (O. tshawytscha). The glucose content of the blood increased to about twice that found in salmon in the sea. Rarely was glucose found in the urine. The concentrations of sodium and potassium decreased, the latter to a marked degree. Cholesterol values rose during the migratory period, then fell at the time of spawning to concentrations lower than those found in sea salmon. Total proteins exhibited a pronounced diminution. Protein-bound iodine decreased progressively from the sea to the spawning grounds. Estimations of the number of red blood cells, hemoglobin content and packed cell volume showed fluctuations during the migration period but by the time of spawning the blood picture was in general like that of the sea salmon. Accompanying the above changes was a progressive rise in the concentration of 17-hydroxycorticosteroids to high levels at the time of spawning. Detailed comparison with the characteristic physiological and histological features of Cushing's syndrome revealed many similarities between the spawning salmon and the human patient suffering from Cushing's syndrome. (Auth. abst.)

4623. Evropeitseva, N. V. 1960. CORRELATION BETWEEN THE PROCESSES OF EARLY DEVELOPMENT OF THE GONADS, AND TRANSITION TO THE SMOLT STATE IN MALES OF THE BALTIC SALMON (SALMO SALAR L.) REARED IN PONDS. (SOOTNOSHENIE PROTSESSOV RANNEGO RAZVITIYA GONAD I PEREKHODA V POKATNOE SOSTOYANIE U SAMTSOV BALTIISKOGO LOSOSYA (SALMO SALAR L.) V PRUDOVYKH USLOVIYAKH.) Zool. Zhur. 39(5): 777-779; Biological Abstracts, Vol. 36, No. 18, Abst. No. 60806. 1961.

The histological characteristics of the testes of the smolt at the time when it assumes its silvery hue, and of the testes of the parr and the May parr, are described. The overwhelming majority of male parrs and May parrs, which did reach a body weight similar to that of most smolts, did not undergo the transition of the near-smolt state, this development being prevented by the onset of a process of early development of the sex glands. The 2 processes are biologically antithetic and the early development of the sex glands brings about the formation of dwarf males in the salmon.

4624. Mukhacheva, V. A., and O. A. Zvyagina. 1960. DEVELOPMENT OF THE PACIFIC OCEAN COD GADUS MORHUA MACROCEPHALUS TILESIUS. (RAZVITIE TIKHOOKEANSKOI TRESKI GADUS MORHUA MACROCEPHALUS TILESIUS.) Trudy Inst. Okeanol. Akad. Nauk SSSR 31: 145-163; Biological Abstracts, Vol. 36, No. 18, Abst. No. 60818. 1961.

The embryonic and larval development of the Pacific Ocean cod is described. Unlike the Atlantic Ocean cod, it has benthic spawn. The fertilized roe are 0.98 mm in diameter; the perivitelline area is small; the sheath is thick and slightly adhesive; the yolk is thick; and there are no fat drops. At a temperature of 5.5°, the incubation period is approximately 15 days. The average length of the prelarvae on emerging is 3.45 mm. The number of segments in the body is 14-15; in the tail, 27-30. On the 3d day after hatching the number of segments is changed: 11-15 in the body; 34-35 in the tail. The yolk sac is resorbed on the 10th day after emergence. Morphologic differences were established between the larvae of the cod, the pollack (Theragra chalcogramma), and the navaga (Eleginus navaga) found in particular regions.

4625. Fortune, P. Y. 1960. THE EFFECT OF INDUCED HYPOTHYROIDISM ON THE DERMAL MELANOPHORES OF TELEOSTS. Proc. Zool. Soc. London 135(1): 55-64; Biological Abstracts, Vol. 36, No. 18, Abst. No. 60833. 1961.

The melanophores of Phoxinus phoxinus and Salmo gairdnerii remain expanded during an initial phase in development. Treatment with thiourea prolongs this phase, which is associated with a hypothyroid condition. The young fry show a difference from the adults in their rate of response to environmental changes. It is suggested that this is due to an internal change, arising as a result of metabolic stress and causing an endocrine imbalance. No effect of thiourea on the melanophores of isolated skin strips, or on the adults of Phoxinus could be demonstrated. (Auth. abst.)

4626. Smith, M. A., V. C. Applegate, and B. G. H. Johnson. 1960. COLORIMETRIC DETERMINATION OF HALOGENATED NITROPHENOLS ADDED TO STREAMS AS SEA LAMPREY LARVICIDES. Analyt. Chem., 1960, 32, 1670-1675; Water Pollution Abstracts, Vol. 34, No. 7, Abst. No. 1233. 1961.

The halogenated nitrophenol, 3-trifluoromethyl-4-nitrophenol (TFM), has recently been found to be useful in controlling larvae of the sea lamprey in certain tributaries of the upper Great Lakes. There is a certain range of concentration in which all larvae are killed without harm to most other forms of aquatic life. A rapid method has been developed for determining TFM in the field, based on the development of a yellow colour under alkaline conditions. Variations in the response of the colorimeter caused by changes in stream colour are corrected by the use of a nomograph to convert instrument readings to p. p. m. TFM.

4627. Velz, C. J., and Gannon, J. J. 1960. DROUGHT

FLOW CHARACTERISTICS OF MICHIGAN STREAMS. Michigan Water Resources Commission, 1960, 786 pp.; Water Pollution Abstracts, Vol. 34, No. 7, Abst. No. 1254. 1961.

This report on drought flows in streams in Michigan contains 5 sections dealing with characteristics of drought flow in streams and an explanation of the methods of analysis used; detailed results obtained in the major drainage basins in the state; data on temperature analyses; and analyses of levels in the Great Lakes. Detailed data are given in tables and graphs.

4628. Weber, E. 1959. FERTILIZERS AND INSECTICIDES AS CAUSES OF DAMAGE TO WATERS. Wass. u. Abwass., 52-61; Water Pollution Abstracts, Vol. 34, No. 7, Abst. No. 1353. 1961.

Dealing with artificial fertilizers, the author discusses the amounts generally used, the concentrations in which, in unfavourable conditions of heavy rain soon after application, they might be washed into streams or ponds, and the toxicity of the various types of fertilizer to fish. It appears that only those containing ammonia constitute a direct danger to fish. There is however a risk that overabundance of plant growth may be encouraged, with the added danger of secondary pollution from dead plants. Of insecticides, arsenical preparations are most dangerous but are now generally replaced by modern contact insecticides containing DDT, 666 (hexachlorocyclohexane), or E 605 (parathion). There is little risk of direct poisoning of fish by spraying or dusting with these materials but a greater risk from washing or emptying vessels. Insect larvae and crustaceans are sensitive, so that fish food may be destroyed, and alteration in natural conditions may prevent self-purification; in spraying or dusting, water surfaces should therefore be avoided. A method of testing the presence of insecticides in fish organs by their effect on flies is described.

4629. Alm, G. 1960. LIMNOLOGICAL-FISHERY INVESTIGATIONS IN KALARNE LAKES. Rep. Inst. Freshw. Res. Drottningholm , No. 41, 5-148. (English summary); Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1430. 1961.

A report, including tabulated and graphical data, is given of investigations carried out at 130 lakes around Kalarne in Sweden. The lakes, all oligotrophic, are considered in 4 groups classified according to the transparency of the water, and the aspects studied included colour, pH value, alkalinity, conductivity, temperature, oxygen content, vegetation, bottom fauna, plankton, and fish populations. The classification based on transparency (humic standard) was shown, in general, to be applicable with regard to most of the other factors, and the existence of the 4 distinctly different types of lake in this limited area illustrates the influence of strictly local conditions.

4630. Marczek, E., and J. Zielinski. 1958. INVESTIGATIONS ON THE EFFECT OF SULPHATE CELLULOSE WASTE WATERS ON THE LIFE OF FISH. Przegl. papiern., 1958, 14, 33-41; Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1534. 1961.

In undiluted waste waters from the manufacture of sulphate cellulose, fish died within 23 hours. Waste waters diluted more than 1: 10 were harmless, as were also biologically treated or strongly aerated waste waters.

4631. Wilson, J. S., and G. G. Fisher. 1960. WEEDS CAN BE A UTILITY PROBLEM. Canad. munic. Util. 1960, 98, No. 8, 29-30, and 54-55; Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1537. 1961

Two articles, describing experiences with chemical weed killers in Canada, are given. (1) Control of cattails in drainage ditches. Wilson, J.S. The author describes the application of Garlon, which contains esters of the 2 herbicides, Dalapon and Silvex, for controlling the growth of weeds in storm-drainage ditches in southwestern Ontario. Garlon is applied by spraying during the period from June to October. The frequency of mechanical cleaning of the ditches, which is more expensive, can be markedly reduced by chemical treatment of the weeds. (2) Total herbicides are boon to utilities. Fisher, G. G. The author discusses the hazard of weeds at electrical, water and sewage utilities and reviews progress in the use of selective and non-selective weed killers. He then discusses the advantages of the triazine derivatives, Simazine and Atrazine, for non-selective weed control.

4632. Tarzwell, C. M., and C. Henderson. 1960. TOXICITY OF LESS COMMON METALS TO FISHES. C. Industr. Wastes, 1960, 5, 12; Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1544. 1961.

Data are tabulated showing the toxicity to fish of several of the less common metals, expressed as the 96-hour TL_m value. The data were obtained using the bio-assay procedure, in both hard and soft waters, with fathead minnows and bluegills as the test fish. Beryllium was found to be the most toxic of the less common metals studied, having a 96-hour TL_m value as low as 0.6 mg per litre in very soft water; uranium was also relatively toxic with a 96-hour TL_m value of about 3 mg per litre in soft water; and the TL_m values of the other less common metals tested ranged from 5-15 mg per litre. For all these metals, the TL_m values in hard water were 10-100 times greater than those obtained in soft water, this lower toxicity probably being due to a lower solubility. It has been found that the toxicity to fish of many trade waste waters depends largely on the pH value, alkalinity, and hardness of the receiving water, and preliminary studies have indicated that a useful graphical relationship can be established satisfactorily for some materials.

4633. Cohen, J. M., L. J. Kamphake, A. E. Lemke, C. Henderson, and R. L. Woodward. EFFECT OF FISH POISONS ON WATER SUPPLIES. PART 1. REMOVAL OF TOXIC MATERIALS. J. Amer. Wat. Wks Ass., 1960, 52, 1551-1566; Water

Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1545. 1961.

In view of the possibility that fisheries management may require the addition of fish poisons to water reservoirs, experiments have been carried out on the effect of these compounds on the water and on methods for removing them from water. The most easily removed fish poison is pure rotenone which can be removed from water by treatment with moderate amounts of activated carbon, by chlorination, or by treatment with chlorine dioxide. The concentration of rotenone in the reservoir decreases rapidly from natural causes, thus reducing the concentration which has to be removed at the treatment plant. Cube powder and any of the formulations containing rotenone or rotenoid derivatives would also be suitable as fish poisons but the amount of chemicals required to remove them from the water is greater than with pure rotenone as the formulations contain synergists such as sulphoxide and emulsifiers. Toxaphene and formulations containing it are not removed from reservoirs by natural causes within a reasonable time, and would require careful treatment at the treatment plant. The use of activated carbon was found to be the only effective method of removing toxaphene; chlorination and coagulation with alum were ineffective.

4634. Bandt, H. J. 1959. WATER TURBIDITY AND FISH. Dtsch. Fisch Ztg, 6, 321-322; Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1549. 1961.

The author discusses the occurrence and origin of turbidity in fishery waters and gives examples of the damage caused to fish, which frequently consists of inflammation of the gills and epidermis.

4635. Fujiya, M. 1961. USE OF ELECTROPHORETIC SERUM SEPARATION IN FISH STUDIES. Wat. Pollut. Contr. Fed., 1961, 33, 250-257; Water Pollution Abstracts, Vol. 34, No. 8, Abst. No. 1550. 1961.

Studies have been made on the possibility of using paper electrophoresis of fish serum to detect incipient harmful effects of waste waters on fish before any outward signs of distress are exhibited. It was found that there are some differences between the sera of elasmobranch and teleost fish, but they are of approximately the same composition and exhibit characteristic electrophoretic curves from which deviations can be measured. The sera of fish exposed to quite low concentrations of materials such as pulp mill waste waters and inorganic chemicals were markedly different from sera of unexposed fish.

4636. Fry, F. E. J. 1960. REQUIREMENTS FOR THE AQUATIC HABITAT. Pulp Pap. Mag. Can., 1960, 61, T.61-T.66; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1600. 1961.

The conclusions of Ellis, M. M., regarding the aquatic conditions necessary to protect fish life (see W.P.R. Summary, 1937, 10, Abstr. No. 1143) are summarized and discussed in relation to the results of more recent investigations. Individual consideration is given to the effects of temperature, concentrations of oxygen and carbon dioxide, pH value, turbidity, and siltation. A list of references is appended.

4637. Alabaster, J. S. 1956. THE TOXICITY OF CERTAIN WEED KILLERS TO TROUT. Proc. 3rd Brit. Weed Control Conf., 1956, 807-808; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1740. 1961.

Data obtained on the toxicity of certain weed killers and plant growth-regulating substances to rainbow trout (Salmo gairdnerii) are tabulated as the 24-hour and 48-hour TL_m values, measured at a temperature of 18°C ± 0.5°C and with the concentration of dissolved oxygen in the water kept close to the air saturation value by aeration with compressed air.

4638. Alabaster, J. S. 1960. TOXICITY OF WEED KILLERS, ALGICIDES AND FUNGICIDES TO TROUT. Proc. 4th Brit. Weed Control Conf., 1960. 2 pp.; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1741. 1961.

Studies on the toxicity of chemicals to trout (see preceding abstract) have been continued and similar data are tabulated on the toxicity of a number of proprietary weed killers, algicides, and fungicides and also several chemicals forming the active ingredient of these substances. The conditions of the tests remained the same; and rainbow trout were generally used as the test fish, but brown trout (Salmo trutta) were used in a few tests.

4639. Ullmann, W. W., R. W. Schaefer, and W. W. Sanderson. 1961. ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE. J. Wat. Pollut. Contr. Fed., 1961, 33, 416-418; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1743. 1961.

Since 1956 sodium arsenite has been used for the control of weeds in Chautauqua and Findley lakes in New York State. In 1959 a study was made to determine the extent of accumulation of arsenic in fish from these lakes; the results were compared with fish from Cassadaga lake which has not been treated with the herbicide. In none of the fish examined was the amount of arsenic found equal to that present in edible salt water fish. The fish from Chautauqua lake contained less arsenic than those from Findley lake; this is attributed to the presence of residual arsenic in the water of Findley lake. It was concluded that longer contact periods are necessary for a significant accumulation of arsenic in fish under these conditions.

4640. Schweiger, G. 1957. THE TOXIC ACTION OF HEAVY METAL SALTS ON FISH AND ORGANISMS ON WHICH FISH FEED. Arch. Fisch Wiss., 1957, 8, 54-78; Water Pollution Abstracts, Abst. No. 1744. 1961.

The author describes and gives the results of in-

vestigations into the toxicity of mercury, cadmium, nickel, cobalt, and manganese salts to one- and two-year-old tench, carp, rainbow trout, and char, and to crustacea, worms, and insect larvae forming the food of fish. The results show that concentrations of 0.2 mg of mercury, 0.03 mg of cadmium, 1 mg of cobalt, or 15 mg of manganese per litre were not harmful to any of the fish or animals tested. The toxic action in 7-day experiments was that of acute poisoning and was similar in its effects on all the animals. Fish showed symptoms of slow suffocation and paralysis and the food organisms showed signs of increasing exhaustion and paralysis. After a considerable period of difficulty in respiration, fish did not recover in fresh water. Examination of skin and gills showed that suffocation was caused by deposition of dead cell matter on the gills and surface of the body; cells were loosened from the gill epithelium and from the body surface. Chemical analysis and spectrographic examination showed the presence of the metals in the slime and deposited cells covering the body and accumulation of manganese and cadmium in the organs. Injection of much larger amounts than were found in poisoned fish showed that the toxic action was due to the destruction of the gill epithelium causing respiration difficulty and final suffocation. Cyprinids and older fish were more resistant than Salmonidae and small fish; this is explained by their lower frequency of respiration and lower oxygen requirements.

4641. Angelovic, J. W., W. F. Sigler, and J. M. Neuhold. 1961. TEMPERATURE AND FLUOROSIS IN RAINBOW TROUT. J. Wat. Pollut. Contr. Fed., 1961, 33, 371-381; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1745. 1961.

Fluorides occur naturally in many waters, especially in the western U.S.A., and may also enter water as a result of leaching from fertilizers and from natural deposits and of the discharge of industrial wastes. Experiments have been carried out on the effect of fluorides and of temperature on the survival of rainbow trout. It was found that the toxicity of fluoride increases with increase in concentration. Increasing temperature can in itself be lethal, the upper lethal temperature being about 75°F, and increasing temperature also increases the toxicity of fluoride, probably because of its effect on the metabolic rate of the fish. The optimum temperature appeared to be 65°F, as fish were able to survive for a longer period at this temperature in a given concentration of fluoride than at other temperatures tested.

4642. Horn, W. M. V. 1960. THE EFFECTS OF PULP AND PAPER MILL WASTES ON AQUATIC HABITAT REQUIREMENTS. Pulp Pap. Mag. Can., 1960, 61, T.67-T.69 and T.80; Water Pollution Abstracts, Vol. 34, No. 9, Abst. No. 1746. 1961.

The author reviews work on the toxicity to aquatic life of waste waters from the kraft and sulphite pulping processes, and on the minimal oxygen requirement of the aquatic habitat, with special reference to the tolerance of fish and fish eggs to low concentrations of dissolved oxygen. It is concluded that if modern kraft mills are operated normally and carefully, there is no hazard to fish life; that oysters are the only aquatic organism of any commercial value which may be vulnerable to sulphite liquor; and that a concentration of 3-4 p.p.m. of dissolved oxygen is sufficient to maintain an adequate aquatic population. A list of 26 references is appended.

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ABSTRACTORS OTHER THAN AUTHORS AND STAFF:

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